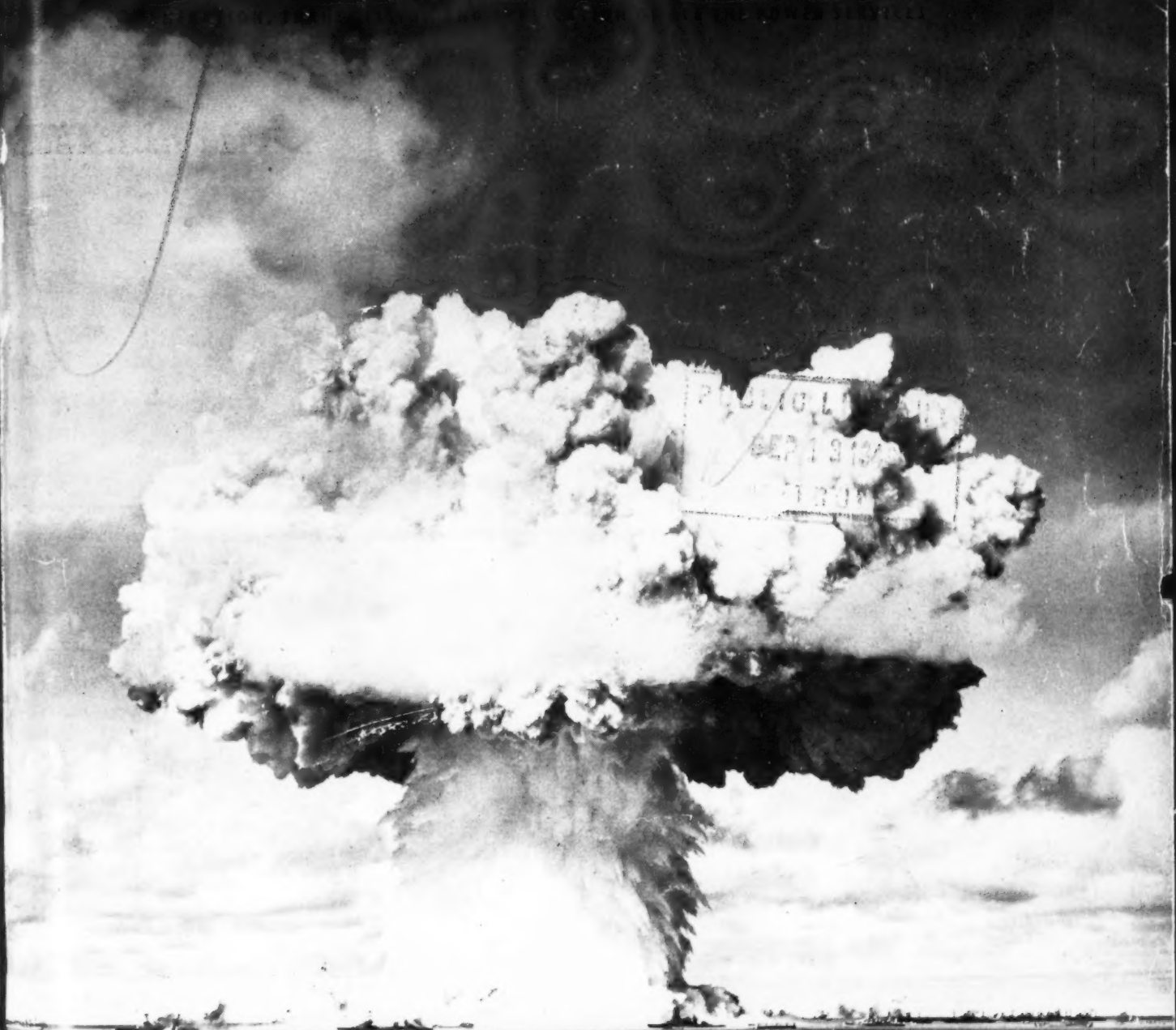
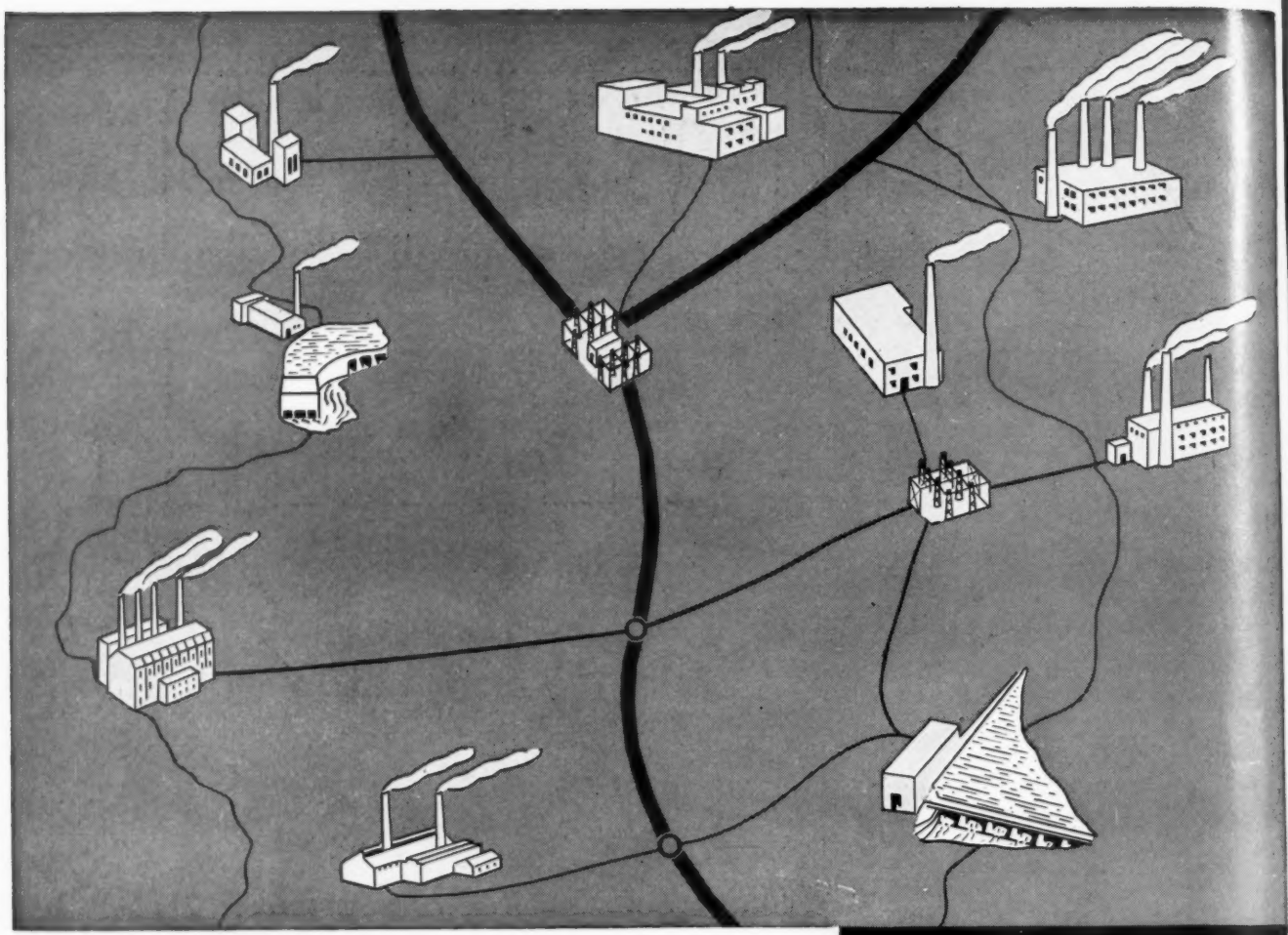
POWER

SEPTEMBER
1946



POWER AT BIKINI • Phil Swain's personal report to power men summarizes the engineering aspects of the atom-bomb tests—p 80



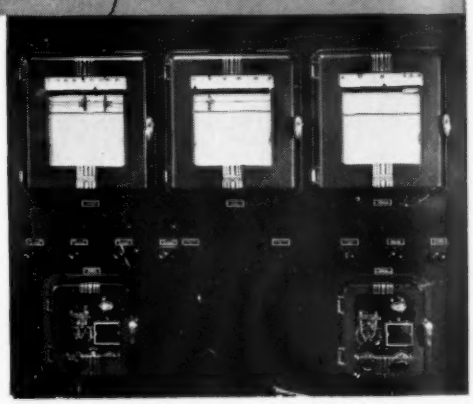
IS YOUR MILL IN A POWER NETWORK?

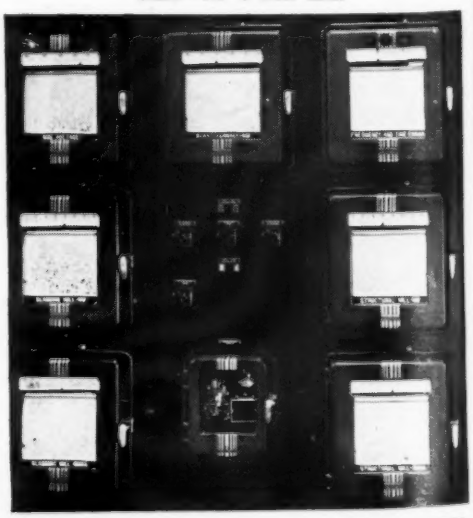
The economy which a load dispatcher customarily maintains—and which is his regular responsibility—can be increased very substantially by giving him two automatic "tools" for his work.

One tool is a Micromax Load Recorder or Recorders to show load conditions promptly and continuously. The other tool is L&N Automatic Load-Frequency Control, to carry out the dispatcher's orders.

A fraction of one per cent of the total investment in a big industrial power plant will provide this equipment. The installation is even more advisable when one recalls the total of this investment.

This is just one reason why power systems which total more than 35,000,000 kw capacity now use these L&N instruments. If you'd like to consider joining this total, an L&N engineer will be glad to sit down with you and explain, or to send Technical Publication N-56-161(1), as you may prefer.





L&N Load Recording and Load-Frequency Controlling Panels. Above—for a Public Utility; below—for a steel mill.

LEEDS & NORTHRUP COMPANY, 4910 STENTON AVE., PHILA., PA.

LEEDS & NORTHRUP

MEASURING INSTRUMENTS · TELEMETERS · AUTOMATIC CONTROLS · HEAT-TREATING FURNACES

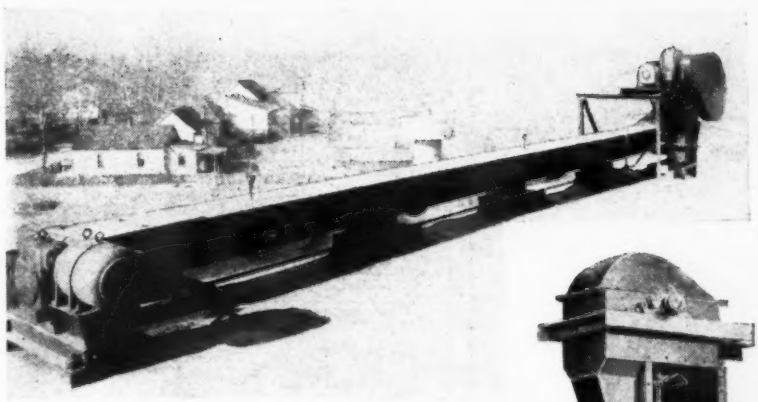
Jrl. Ad N-50-161(4a)

POWER (with which are consolidated "Science and Industry," "The Engineer Review," "The Engineer," "The Stationary Engineer"), September, 1946, Vol. 90 No. 9. Published monthly with an additional Directory in December. McGraw-Hill Publishing Company, Inc. Publication office, 99-129 N. Broadway, Albany 1, N. Y. Editorial and executive offices, 330 W. 42nd St., New York 18, N. Y. Entered as second class matter August 25, 1936, at Albany, N. Y., under the act of March 3, 1879. Printed in U. S. A. Allow at least ten days for change of address. All communications about subscriptions should be addressed to the Director of Circulation, Power, 330 W. 42nd St., New York 18, N. Y. Subscription rates—U. S. and U. S. Possessions, $5 for one year, $8 for two years. 50c per single copy Canada, $6 for one year, $9 for two years. Pan American countries, $10 for one year, $16 for two years. All other countries $15 for one year, $25 for two years.

Bulk-Flo Handles Coal Economically from Car to Storage Bin at Starch Plant

• The problem of the Union Starch & Refining Company, Granite City, Illinois, was to handle coal without manual labor from hopper bottom cars — horizontally 30′, then vertically 50′, then to an overhead bin feeding an automatic stoker on a dryer for reducing moisture content of gluten feed.

The answer was a Link-Belt BULK-FLO unit, discharging to a screw conveyor with multiple discharge points. In addition to cutting handling cost and saving manual labor, this setup is self-feeding from bottom of track hopper . . . is compact and fully enclosed . . . has underground horizontal run . . . eliminates auxiliary construction . . . is equipped with automatic limit switches. Link-Belt is prepared to help you solve similar problems. Send for catalogs.



This is but one of the many variations of setup possible with BULK-FLO, which combines the functions of conveyor, elevator and feeder in a single unit of high capacity. The material conveyed occupies practically the full area of the carrying duct. Loads automatically at one or several points; and automatically discharges at the head end of the vertical runs, or at one or more points on horizontal runs

10,415

LINK-BELT

Bulk-Flo

ELEVATOR-CONVEYOR-FEEDER

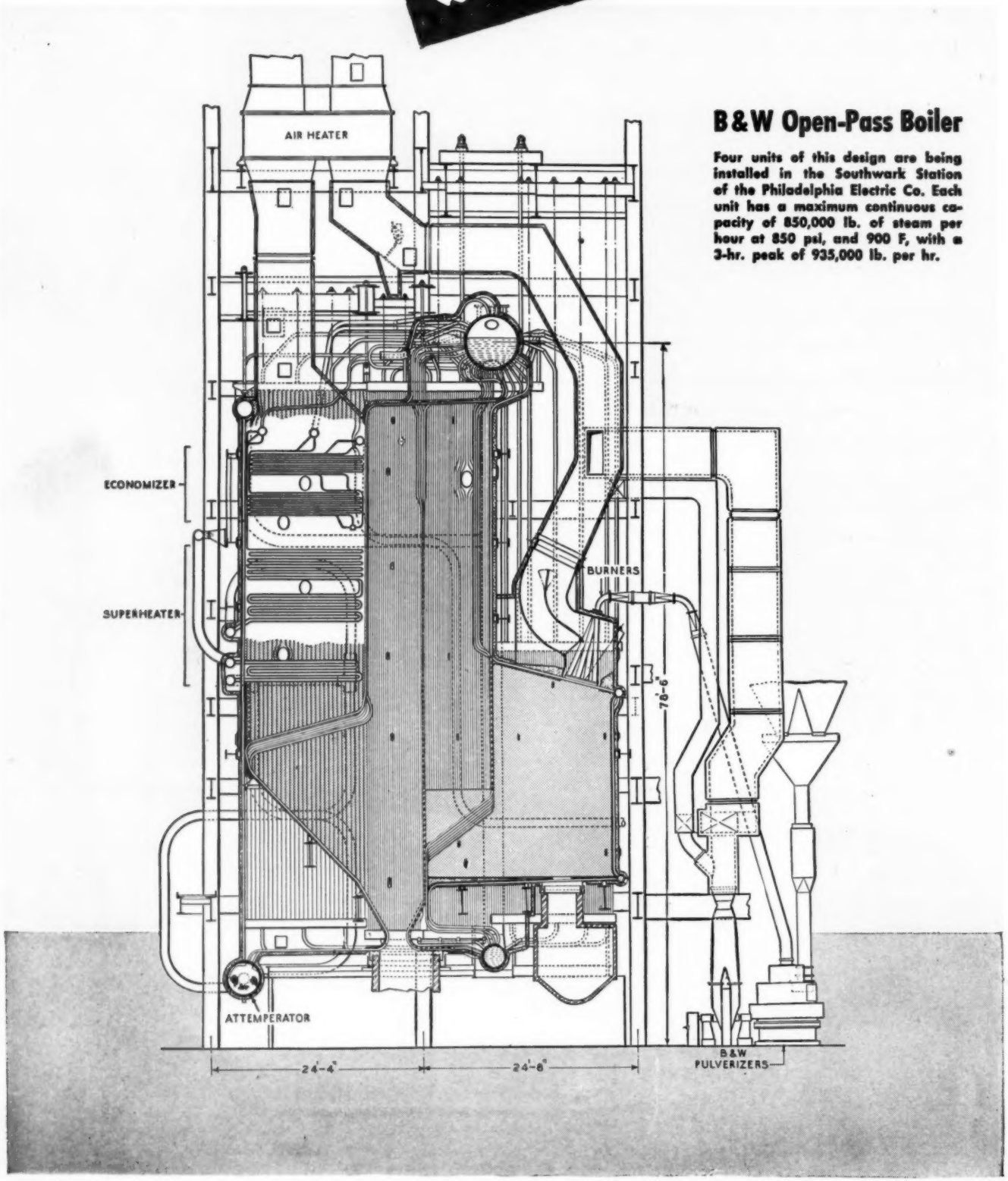
General view of Link-Belt L-path Bulk-Flo conveyor-elevator-feeder for handling coal from track dump hopper, through a shallow tunnel under ground, up side of building to L-B screw conveyor on roof. Screw, in turn, discharges into overhead bunker within building.

LINK-BELT COMPANY

Chicago 8, Indianapolis 6, Philadelphia 40, Atlanta, Dallas 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8. Offices in Principal Cities.

Steam for Southwark

B&W BOILERS



B&W Open-Pass Boiler

Four units of this design are being installed in the Southwark Station of the Philadelphia Electric Co. Each unit has a maximum continuous capacity of 850,000 lb. of steam per hour at 850 psi, and 900 F, with a 3-hr. peak of 935,000 lb. per hr.

Selected for *NEWEST*

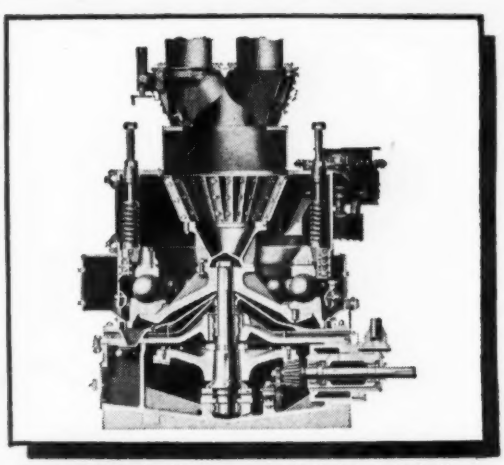
Philadelphia Electric Station

Reliability and simplicity were the foremost aims of the Philadelphia Electric Company in constructing and equipping its new Southwark Station, which will carry a large portion of the system's capacity. Comprehensive study of plant requirements and service conditions led to the selection of four B&W Open-Pass Boilers for this, the first station in the system to use only pulverized coal.

A factor, too, in the selection of B&W units for Southwark was Philadelphia Electric's satisfactory experience with similar B&W Boilers at its Chester Station.

On the basis of these two criteria—through study of plant needs, and past performance—B&W Boilers were indicated as the most attractive units from the standpoint of investment and operating costs consistent with estimated load conditions and capacity factor for the station's anticipated life.

Your requirements probably differ from those at Southwark. But whatever they are, B&W welcomes the kind of thorough analysis and close comparison that influenced the selection of B&W Boilers there. It's a good way to go about choosing the right boilers for low over-all power cost—and B&W is ready to help power engineers in *any* plant to achieve just that.



Four B&W Pulverizers supply fuel for each boiler. Practically full rated output can be obtained with coals having grindability as low as 55.

G-339 T

Water-Tube Boilers, for Stationary Power Plants, for Marine Service . . . Water-Cooled Furnaces . . . Superheaters . . . Economizers . . . Air Heaters . . . Pulverized-Coal Equipment . . . Chain-Grate Stokers . . . Oil, Gas and Multifuel Burners . . . Seamless and Welded Tubes and Pipe . . . Refractories . . . Process Equipment.

BABCOCK & WILCOX

THE BABCOCK & WILCOX CO.
GENERAL OFFICES: 85 LIBERTY ST., NEW YORK 6, N.Y.
WORKS: ALLIANCE AND BARBERTON, O.; AUGUSTA, GA.

There's a lot of protection i

You will find Twin Strainers in most power plants as well as in process applications. They strain every liquid from gasoline to paint, in fact any liquid that will pass through a strainer. The amount of equipment they protect, rated either in capacity or in monetary value, cannot be computed but must be enormous. Occasionally we hear of Twin Strainers still faithfully serving after twenty or thirty years on the job.

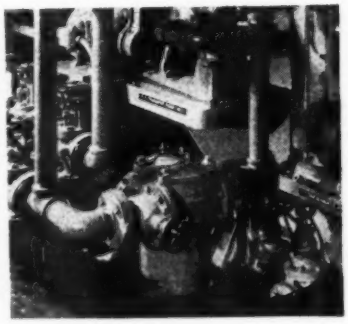
Straining is an Elliott specialty and has been for many years. Elliott Twin Strainers, Single Strainers, Oil Strainers, Self-Cleaning Strainers have long been favorites in their different fields wherever clear liquids are required.

If you have a straining problem, Elliott engineers can supply the right answer. Write us.

OTHER ELLIOTT STRAINERS *and* ACCESSORIES

TWIN OIL STRAINERS

Built on the Twin Strainer principle, adapted to the needs of oil line protection — both fuel and lube oil. Compact, sturdy, providing uninterrupted service. In sizes from 1" to 12".

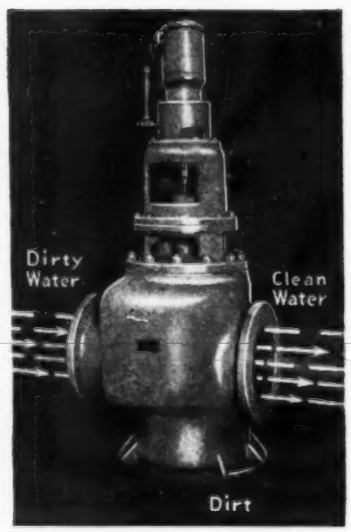


SINGLE STRAINERS

Where conditions do not require constant straining service, and the liquids to be strained do not contain too large a quantity of foreign material, single strainers will fill the need economically. The strainer basket is quickly accessible and easy to handle. Sizes from 1" to 24". Working pressures to 125 psi.

SELF-CLEANING STRAINERS

Used for applications where too frequent manual cleaning would be necessary. A slowly rotating element progressively seals off individual sections, permitting back flushing of arrested material. Requires no attention beyond occasional general inspection. Sizes from 4" to 24".



DESUPERHEATERS

Another Elliott specialty. Simple and reliable, they reduce superheat, or convert superheated to saturated steam. Construction prevents water being picked up and carried over with the steam. In several types covering a wide range of operating conditions.

LIST OF PRODUCTS: STEAM TURBINES • GAS TURBINES • GENERATORS
MOTORS • CONDENSERS • FEEDWATER HEATERS AND DEAERATORS
STEAM JET EJECTORS • CENTRIFUGAL BLOWERS • TURBOCHARGERS FOR
DIESEL ENGINES • TUBE CLEANERS • STRAINERS • DESUPERHEATERS • FILTERS

in TWIN STRAINERS

THEY STOP TROUBLE BEFORE IT STARTS

A lot of what might have been bad trouble is caught in the strainer basket being withdrawn for dumping. These baskets are available in many sized meshes, for all straining needs. They are usually large enough in relation to pipe size, to present minimum impedance to liquid flow.

THEIR GUARD NEVER RELAXES

One of the cylinders is always working. It is not necessary to clean a cylinder immediately after it becomes fouled. The flow can be diverted to the twin cylinder and the fouled cylinder cleaned when convenient.

THEY ARE EASILY CLEANED

By backing off a few nuts and removing the clamping bars, the cover can be raised and the basket lifted out for dumping. The entire operation need take only a few minutes. The need for cleaning is usually indicated by a pressure gage, the building up of pressure beyond a standard point indicating that the basket mesh is becoming clogged with foreign matter.

GATE VALVES SWITCH THE FLOW

from one straining chamber to the other. These valves each have a single disc which travels between two seats, sealing off one chamber while opening the other for duty. Disc brushes off solid or foreign material which may cling to valve seat, assures against scoring or leakage. In some sizes of Twin Strainers the two valves are linked by a drive chain running over sprockets, thus turn simultaneously. In larger sizes they can be motor-driven. Twin Strainers are built in sizes from 2" to 42".

STREAM-LINED FLOW OF LIQUID

is provided by the avoidance of sharp turns in channels leading to and from straining chambers. Smooth easy curves are the rule, with generous dimensions in channels and straining chambers.

HEAVY, SOLID CONSTRUCTION

Twin Strainers have always been of substantial cast construction, heavy and essentially sturdy. The three elements solidly bolted together are the center section containing the twin straining chambers, and the two end sections carrying valves. Valve mechanisms are easily reached through large hand holes.

A-295

ELLIOTT COMPANY

Accessories Dept., JEANNETTE, PA.
Plants at: JEANNETTE, PA. • RIDGWAY, PA.
SPRINGFIELD, O. • NEWARK, N. J.
DISTRICT OFFICES IN PRINCIPAL CITIES

SOOT BLOWING

With AIR

INSTEAD OF STEAM

IS BETTER-

AND OFTEN CHEAPER

AIR

AS A CLEANING MEDIUM

SAVES FEED WATER MAKEUP

SAVES LABOR

SAVES MAINTENANCE

SAVES FUEL

SAVES PIPING INSULATION

DIAMOND AUTOMATIC SEQUENTIAL

There is no condensate loss due to soot blowing using compressed air instead of steam as the cleaning medium, with the Diamond Automatic Sequential Air System. This is a particularly important feature where feed water makeup is a problem. And having a greater density than steam, compressed air provides better cleaning.

The air is discharged from permanently installed elements (see below) in a series of short puffs with substantial pauses between. Spreading the cleaning cycle over a longer period of time eliminates stack discharge nuisance and permits use of a much smaller compressor.

The "human element" is entirely eliminated from soot blowing by the Diamond automatic sequential system which assures the positive operation of each blower unit in correct sequence and at the right speed every time. No blower unit can be overlooked or incorrectly operated by a careless operator. All soot blower units on the boiler, superheater, economizer, and air heater are controlled from a single panel (see below).

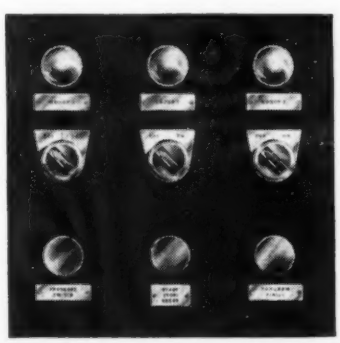
Labor is saved because no attendant is needed to drain the piping, warm it up and then operate each individual blower unit. Experience gained during several years' operation on a number of installations proves that maintenance costs are unusually low and that air blowing requires only ⅓ to ⅔ of the energy from the coal pile that is needed for steam blowing.

The Diamond Automatic Sequential Air Soot Blower System has been in successful central station use on boilers as large as 900,000 lb/hr units since 1940. For further information ask for Bulletin No. 956.

DIAMOND POWER SPECIALTY CORPORATION

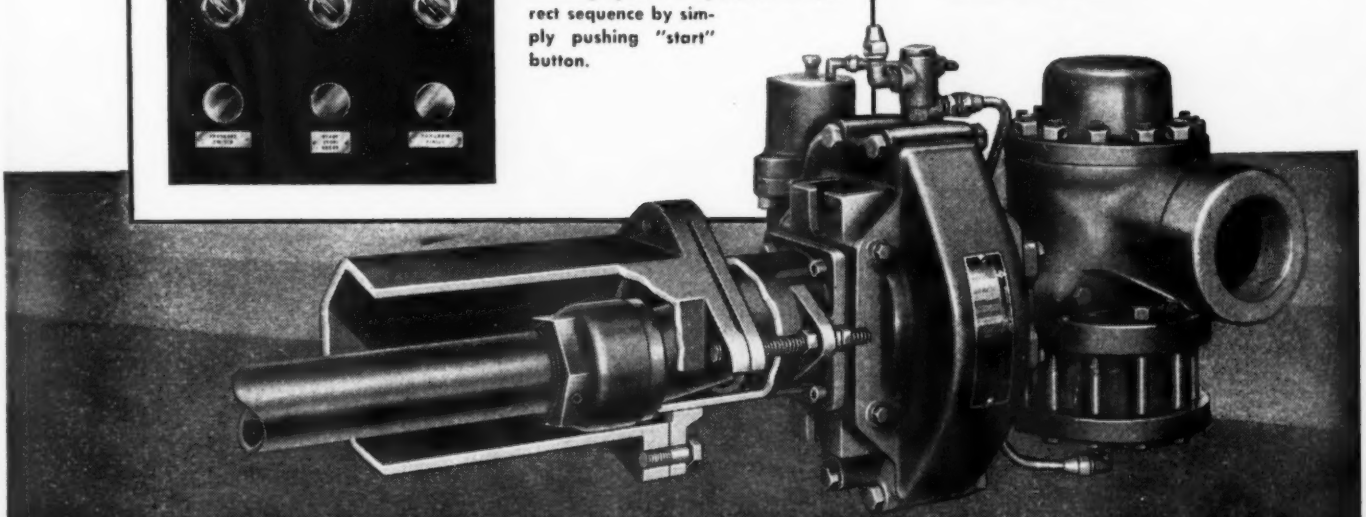
Detroit 31, Michigan

Diamond Specialty Limited • Windsor, Ontario



Program panel at left controls both fixed and retracting blowers arranged in three groups; any desired number of groups can be had when system is designed. Entire soot blowing system is operated in correct sequence by simply pushing "start" button.

Shown below is the Diamond Air Puff Soot Blower having element permanently installed inside the setting; various types of retracting soot blowers are also used in the Diamond Automatic Sequential Air Soot Blower System.



Air SOOT BLOWER SYSTEM

★ MORE THAN 5 MILLION

Represented by these Utility Repeat

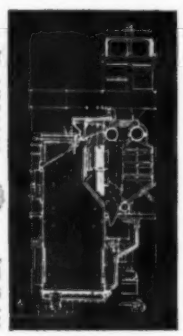
SHERMAN CREEK

Repeats

WITH ANOTHER

MILLION-POUND UNIT

A C-E Steam Generating Unit, designed for a pressure of 1000 psi, a total steam temperature of 955 F and a capacity of 1,000,000 lb of steam per hr, was placed in service in 1943 by the Consolidated Edison Company of New York at Sherman Creek Station. . . . A duplicate unit has recently been ordered.



COMBUSTION ENGINEERING

HARDING ST. STATION

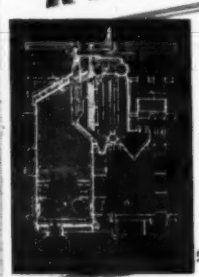
REPEATS

with another

400,000 lb. unit

A C-E Steam Generating Unit, designed for a pressure of 975 psi, a total steam temperature of 940 F and a maximum steam capacity of 400,000 lb of steam per hr, was placed in service in 1942 by the Indianapolis Power & Light Company at their Harding Street Power Station.

A duplicate unit has recently been ordered.



COMBUSTION ENGINEERING CO., Inc.

PORT WASHINGTON

Repeats

FOR THE SECOND TIME

A C-E Steam Generating Unit, designed for a pressure of 1280 psi, a total steam temperature of 825 F and a maximum continuous capacity of 600,000 lb of steam per hour was placed in service late in 1935 by Wisconsin Electric Power Company at its Port Washington Station.

A unit of the same type was purchased in 1940. And now a third unit has been ordered.

COMBUSTION ENGINEERING

MONTVILLE

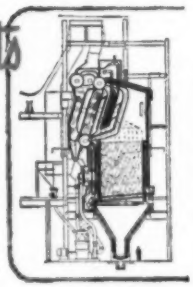
Repeats

WITH ANOTHER

BIG C-E UNIT

Two C-E Steam Generating Units, each designed for a pressure of 700 psi, a total steam temperature of 825 F and a maximum capacity of 450,000 lb of steam per hr, were placed in service in 1937 by the Connecticut Light and Power Company at its Montville Station.

A 500,000 lb capacity unit, designed for a steam pressure of 975 psi and total temperature of 900 F has recently been ordered.



COMBUSTION ENGINEERING

ROCHESTER

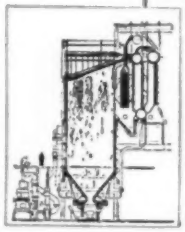
Repeats

with another **BIG unit**

A C-E Steam Generating Unit, designed for a pressure of 750 psi, a total steam temperature of 725 F and a maximum continuous capacity of 250,000 lb of steam per hr was placed in service in 1936 by the Rochester Gas & Electric Company in Station No. 5. Similar units were added in 1937, 1938 and 1940.

In 1942 a larger unit of 300,000 lb capacity, for 850 F total steam temperature, was added.

Recently a fifth unit of 400,000 lb capacity was purchased.



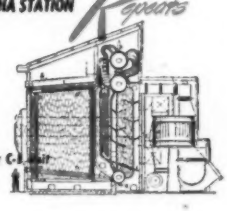
COMBUSTION ENGINEERING

200 MADISON AVENUE, NEW YORK 16, N. Y.

SOUTH OMAHA STATION

Repeats

with another C-E unit



Two C-E Steam Generating Units of the "Outdoor" type shown above were placed in service in 1928 by the Nebraska Power Company, Omaha, Nebraska at South Omaha Steam Electric Station. These were C-E Units, Type VU, designed for a pressure of 525 psi, total steam temperature of 750 F and a maximum continuous capacity of 200,000 lb of steam per hour. Another of these Outdoor units has recently been ordered.

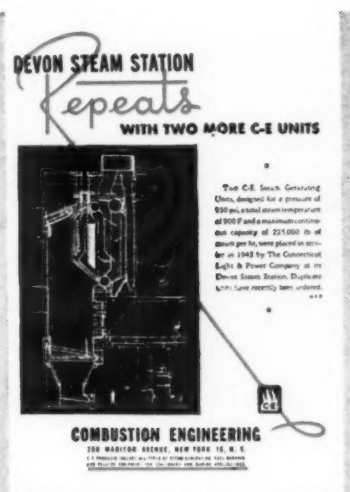
Combustion Engineering

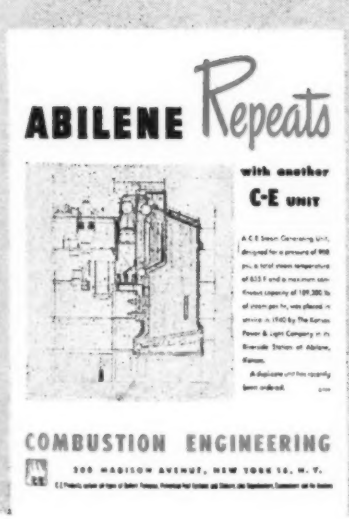
COMBUSTION

C-E PRODUCTS INCLUDE ALL TYPES OF BOILERS, FURNACES, PULVERIZED FUEL SYSTEMS AND STOKERS; ALSO SUPERHEATERS, ECONOMIZERS AND AIR HEATERS

POUNDS OF STEAM PER HOUR

Orders for CE Units over 1-year period



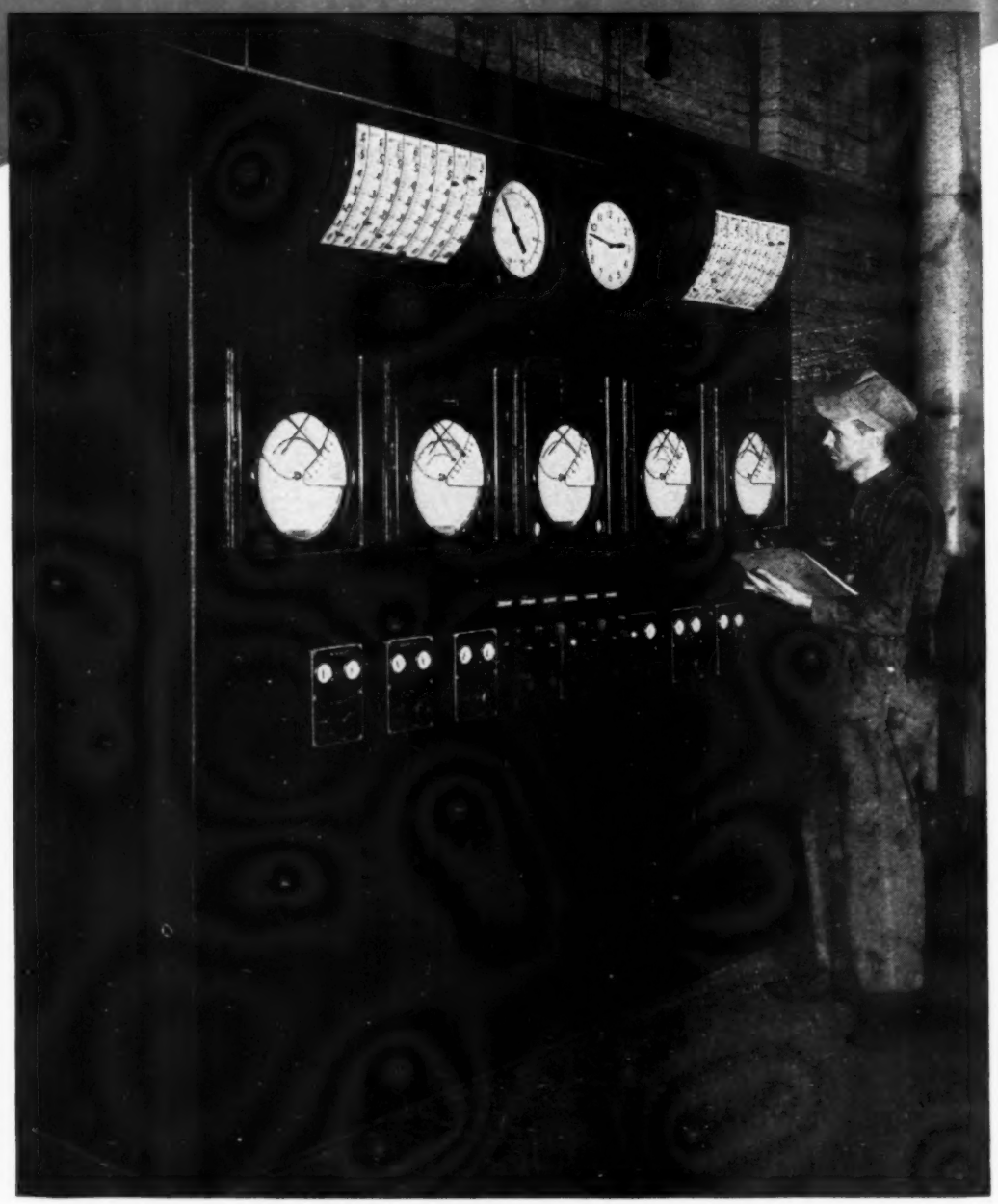


★ *Above are reproductions of advertisements published during period June 1945—June 1946 featuring repeat orders for C-E utility units with capacities ranging from 190,000 to 1,000,000 lb steam per hr.*

ENGINEERING A-980

200 MADISON AVENUE, NEW YORK 16, N. Y.

How to get A "SWEET" CONTROL



Control of two 65,000 lb. per hour boilers is based on the accurate measurements of these Bailey Meters at The White Motor Co., Cleveland, Ohio. Day to day evaporation runs consistently above the guarantee.

JOB

There's More to Boiler Controls Than Regulators

If you want a sweet running control for your boiler plant—look to more than bare regulators when you write your specifications. Here are some additional points to consider:

1 *Insist on controllable equipment*

Fans, dampers, pulverizers, stokers, burners, and other equipment must be adaptable to automatic control before any system can give truly satisfactory results.

2 *Control from all important variables*

Multiple element control systems which respond to all of the important variables, insure against costly disturbances in plant operation. They increase safety, decrease auxiliary power required, and reduce the storage capacity needed in heaters and boiler drums.

3 *Profit from the experience of others*

Steam plants similar to yours already are being operated at optimum performance by Bailey Boiler Control. Your dividends, from our experience in making thousands of boiler control installations, take the form of refinements in control application which insure trouble free operation. Over 8,000 boiler units have been equipped with Bailey Controls during the past ten years. These units range from 3,000 to 1,000,000 pounds per hour capacity and operate at pressures from 75 to 2,500 psi. They are fired by pulverized coal, stokers, oil, gas, mixed fuels and waste fuels.

4 *Operate control from accurate measurements*

A control system is no better than the measurements to which it responds. Bailey Controls are based on accurate measurements made by Bailey Meters.

5 *Consult Qualified Application Engineers*

Bailey Engineers are qualified by training and experience to consult with you on both the theoretical and practical aspects of your boiler control problems. These specialists are conveniently located in over 30 industrial areas throughout the United States and Canada.

Details for Your Problems

If you want details write for a copy of Bulletin 15-D or ask a Bailey Engineer to call.

BAILEY METER COMPANY

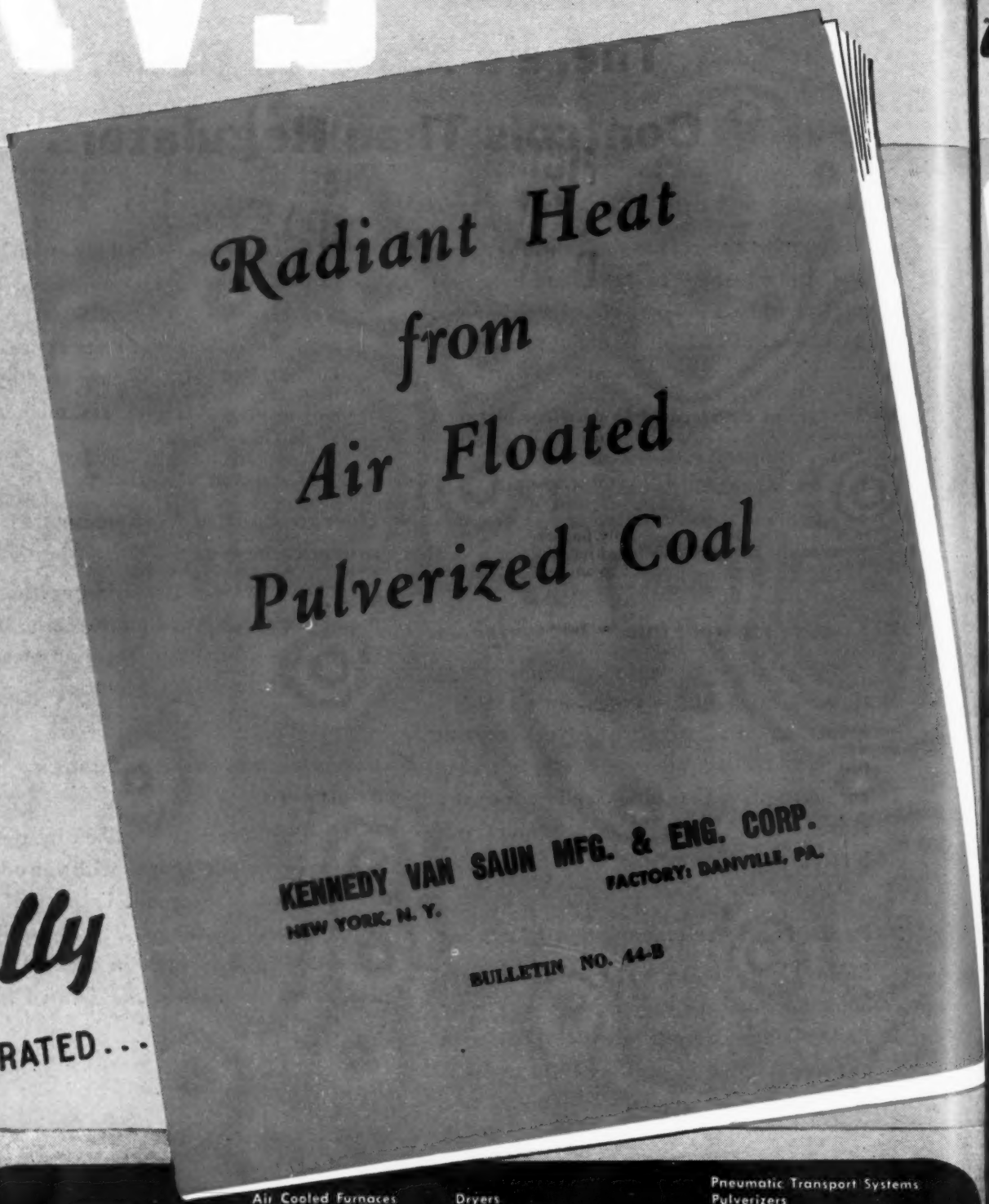
1036 IVANHOE ROAD . . . CLEVELAND 10, OHIO

Controls for Steam Plants

COMBUSTION • PRESSURE
FEED WATER • LIQUID LEVEL
TEMPERATURE • FEED PUMPS

A-98

KVS STEAM



Fully ILLUSTRATED . . .

KVS EQUIPMENT

Air Cooled Furnaces
Air Preheaters
Air Swept Tube Mills
Ball Mills
Classifiers
Coal Crushers
Conveyors
Coolers
Dryers
Economizers
Elevators
Fans
Feeders
Gearless Gyratory Crushers
Jaw Crushers
Kilns
Pneumatic Transport Systems
Pulverizers
Rod Mills
Roll Crushers
Soaking Pit and Deheaters
Steam Generators
Superheaters
Tube Mills
Water Cooled Furnaces

GENERATION
and what it achieves...

...in terms of EFFICIENCY, ECONOMY and LOW MAINTENANCE...are fully described in this 97 Page ENGINEERING HAND BOOK ... BULLETIN NO. 44B

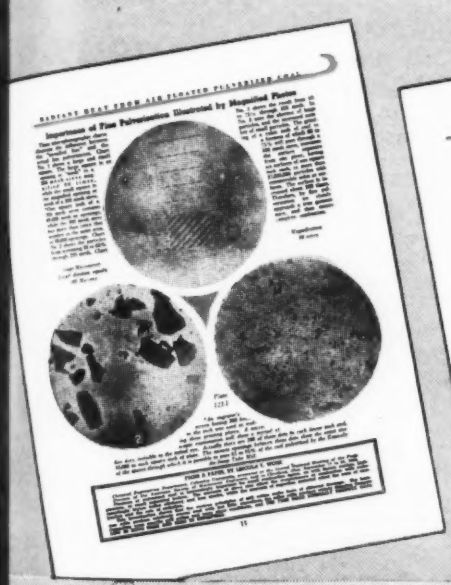
PARTIAL LIST OF SUBJECTS COVERED

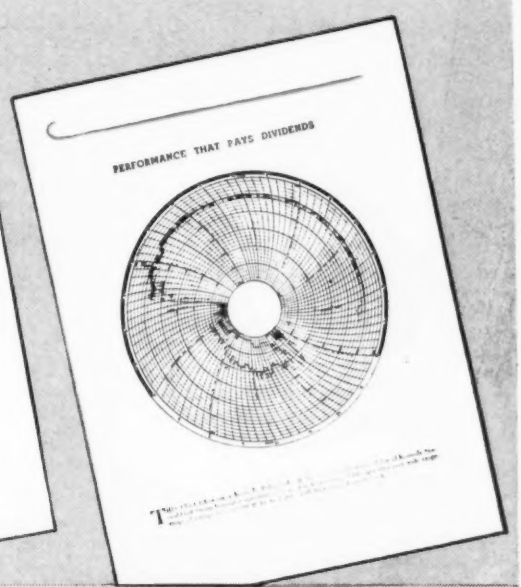
How to obtain efficient results from the use of pulverized coal.
The Air Swept Tube Mill and its importance as a pulverizing medium.
Requisites for true Radiant Heat.
Pulverized Coal-Steam Generators
Design of Air-Cooled and Water-Cooled Furnace Walls.
Reports of steam generator operation and economies effected.
Steam Generator designs for the use of pulverized coal, oil, gas and waste products.
Modernization of steam generating equipment.

These and many other subjects, equally important to power plant engineers, are authoratively presented in this Hand Book. All factual information is based on long, specialized engineering experience in the field of steam generation and should prove of invaluable assistance to anyone interested in modern steam plant design and economy.

ASK FOR YOUR COPY TODAY

Simply make your request for Bulletin No. 44B on your company letterhead. No obligation is incurred.





KENNEDY-VAN SAUN · QUALITY · SERVICE · Kennedy Products · NEW YORK USA · MFG. & ENG. CORP.

Kennedy-Van Saun
MANUFACTURING AND ENGINEERING CORPORATION

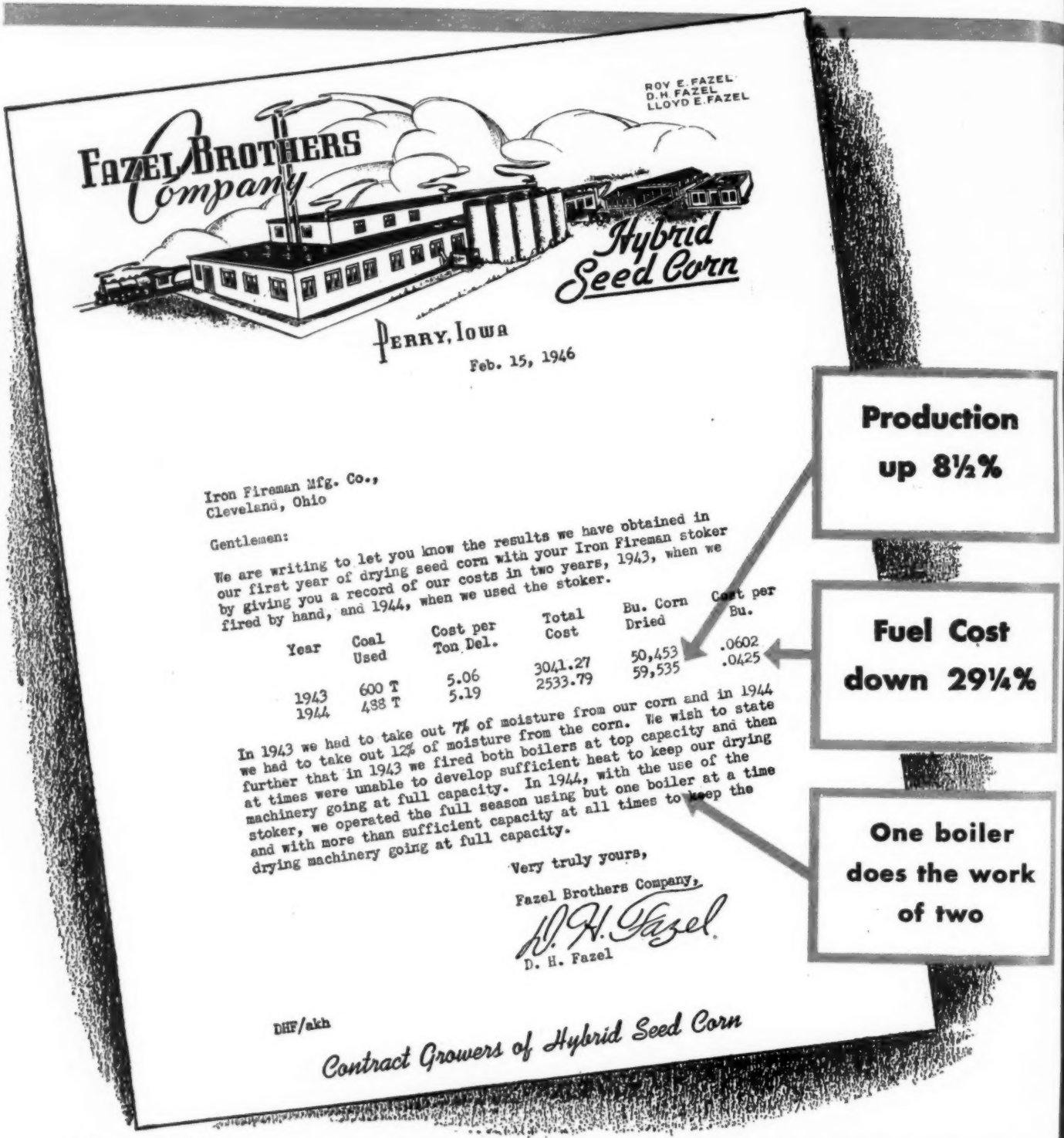
ARMY E NAVY

2 PARK AVENUE • NEW YORK 16, N. Y.

FACTORIES: DANVILLE, PA.

CANADA • ENGLAND • FRANCE • AUSTRALIA

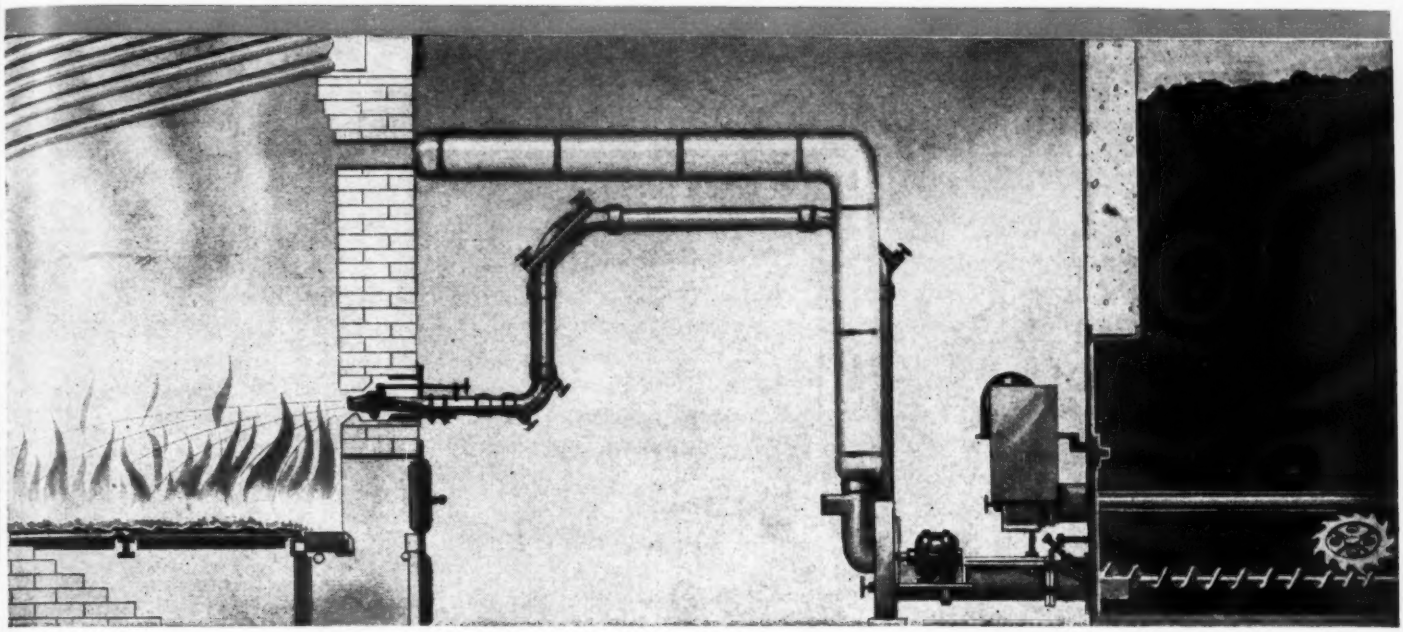
How do IRON FIREMAN


ROY E. FAZEL
D.H. FAZEL
LLOYD E. FAZEL
FAZEL BROTHERS Company
Hybrid Seed Corn
PERRY, IOWA
Feb. 15, 1946
Iron Fireman Mfg. Co.,
Cleveland, Ohio
Gentlemen:
We are writing to let you know the results we have obtained in our first year of drying seed corn with your Iron Fireman stoker by giving you a record of our costs in two years, 1943, when we fired by hand, and 1944, when we used the stoker.
Year | Coal Used | Cost per Ton Del. | Total Cost | Bu. Corn Dried | Cost per Bu.
1943 | 600 T | 5.06 | 3041.27 | 50,453 | .0602
1944 | 488 T | 5.19 | 2533.79 | 59,535 | .0425
In 1943 we had to take out 7% of moisture from our corn and in 1944 we had to take out 12% of moisture from the corn. We wish to state further that in 1943 we fired both boilers at top capacity and then at times were unable to develop sufficient heat to keep our drying machinery going at full capacity. In 1944, with the use of the stoker, we operated the full season using but one boiler at a time and with more than sufficient capacity at all times to keep the drying machinery going at full capacity.
Very truly yours,
Fazel Brothers Company,
D. H. Fazel
D. H. Fazel
DHF/akh
Contract Growers of Hybrid Seed Corn
Production up 8½%
Fuel Cost down 29¼%
One boiler does the work of two

HEAVY DUTY AUTOMATIC COAL STOKER

IRON

STOKERS get these results?



The Iron Fireman Pneumatic Spreader Stoker meters steam size coal from hopper or main coal bunker to transfer housing, where coal is picked up by a pneumatic conveyor and delivered to the furnace. The conveyor nozzle accurately spreads the larger particles of coal over the entire grate in a shallow, uniform fuel bed. The preheated fines burn in suspension, reducing the cinder carry-over and greatly improving the combustion efficiency and responsiveness, as compared with other stokers which do not preheat fuel.

Gets more heat from lower cost coal

The Iron Fireman Pneumatic Spreader stoker not only saves tonnage by more efficient combustion but cuts the cost per ton by using lower cost stoker coal. This scientifically controlled rate of burning enables Iron Fireman to efficiently burn the small size and low ash fusion coals as well as sub-bituminous and lignite. Complete burning gives more heat to answer fluctuating load demands.

Automatic controls eliminate wasteful firing

The positive control of fuel and air supply is the key to Iron Fireman efficiency. Adjusting the rate of fuel feed and the distribution of undergrate air to maintain the requisite steam supply, Iron Fireman regulated firing virtually eliminates smoke and clinkers which mark wasteful firing. Throughout the entire firing cycle the same high combustion efficiency is maintained by sensitive, positive control of all factors of combustion.

Dependable and flexible in operation

Rugged in construction yet delicate in operation Iron Fireman's dependability is reflected in 23 years of providing complete heating satisfaction. Highly responsive to widely changing steam demands Iron Fireman Pneumatic Spreader stoker gives a flexibility of operation to meet any boiler room need. Installation, made by trained Iron Fireman engineers, will be designed to fit your particular heating system.

What about YOUR boiler room?

A survey in your plant made without cost or obligation to you, will show what Iron Fireman stokers will accomplish in your boiler room. Take advantage of the high combustion efficiency, the utilization of low-cost fuel, low labor costs, and minimum maintenance costs which Iron Fireman offers. For such a survey or literature address Iron Fireman Manufacturing Company, 3047 West 106th Street, Cleveland, Ohio. Other plants in Portland, Oregon; Toronto, Canada.

FIREMAN

FOR POWER PROCESSING AND HEATING

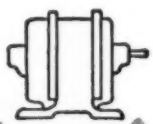
Save Space · Save Money-

in Panelboards and Switches

You can get fuller use out of every switch or panelboard on Motor Circuits by Installing Fusetrons. The tremendous time-lag of Fusetrons permits them to hold starting currents or other harmless overloads. Hence they can be used in sizes nearer to the actual *operating* load of the circuit.

Ordinary fuses have little time-lag. To keep them from opening on starting currents they must be used in sizes much larger than the actual operating load. This means that OVERSIZE equipment must be provided for them.

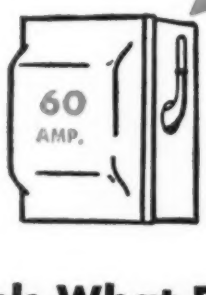
To get a picture of what Fusetrons can do for you let's take a 15 amp. motor as an example. Then you can figure the advantage of installing Fusetrons on all your circuits



15 amp Motor

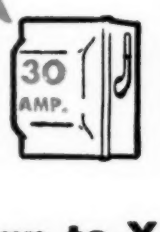
With ORDINARY FUSES

a 60 ampere switch is commonly installed because 45 ampere fuses must be used to hold the motor starting current



OVERSIZE Switch or panelboard

PROPER SIZE Switch or panelboard



With BUSS FUSETRONS

a 30 ampere switch is installed because on normal installation, 15 ampere Fusetrons can be used. They will hold the starting current of the motor

Think What Fusetrons Can Mean to You in Saving Space, Time and Money

On NEW installations

● You can use Fusetrons in sizes smaller than would be possible with ordinary fuses. This means you can SAVE SPACE because you install smaller size switches and panelboards.

Saving space often permits you to locate switches and panelboards in more convenient spots than would be possible if ordinary fuses or other protective devices were used

You also get some additional saving on fuse replacement costs because small size Fusetrons generally cost less than larger size fuses

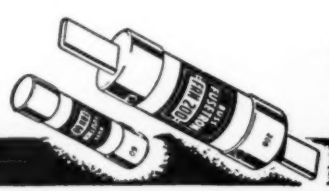
On PRESENT installations

If you want to increase the size of a motor on a circuit—or add more motors—Fusetrons can often save you the cost of installing a larger switch or panelboard. Fusetrons hold starting currents, hence permit a great increase in the actual running load on the switch or panel.

Instead of tearing out your present switch or panel you just replace the ordinary fuses now in it with Fusetrons.

Often too, this saves the trouble and worry of looking for a spot to locate OVERSIZE equipment required by ordinary fuses or other protective devices.

Fusetrons give you a chance to *get full use* from every switch and panelboard in your plant



BUSS

Get Better Protection

With BUSS FUSETRONS

PROOF

Fusetrons saved money for a large Chemical Company in Michigan

Says the Vice President in charge of production, "several months ago we changed the motor on an induced-draft fan in our plant from 50 h. p. to 75 h. p..

A 200 ampere switch was already installed and there was really no place for a larger switch.

Our Electrical Engineer solved the problem by installing Fusetrons in the 200 ampere switch, thus saving the expense of buying a larger switch.

The old switch with the Fusetrons operates entirely satisfactorily—there has not been a single blow."

It may save you money and space to remember this experience the next time you must increase a motor load—or make a new motor installation.

WHAT IS THE FUSETRON?

The Fusetron is a DUAL element device—a Fuse to which is added a Thermal Cutout.

The result: a fuse with tremendous time-lag and much less electrical resistance.

Fusetrons have same degree of Underwriters' Laboratory approval for both motor-running and circuit protection as the most expensive devices made.

Fit standard fuse clips

Fusetrons are made to same dimensions as ordinary fuses and fit all standard fuse holders.

They are obtainable in all sizes from 1/10 to 600 ampere in both 250 and 600 volt types. Also in tamper-resisting type (Fustats) for 125 volt circuits.

Their cost is surprising low

Get All the Facts

Get Better Protection—Send the Coupon Now

Even one lost motor or one needless shutdown or one destroyed panel may cost you more than replacing every fuse with a Fusetron. Don't risk such losses, change over the whole plant to Fusetrons.

BUSSMANN MFG. CO., ST. LOUIS 7, MO.

Division McGraw Electric Co.

Get Many Kinds of Protection Heretofore Not Available by Installing Fusetrons Throughout the Electrical System

★ ***Entirely wipe out needless blows caused by motor starting currents or other harmless overloads.***

Fusetrons have tremendous time-lag. They hold 500% load more than 10 seconds whereas most sizes of ordinary fuses blow in less than one second. They won't open on starting currents or harmless overloads (heavy overloads for a short time or light overloads for a longer time). Fusetrons won't shut down a circuit needlessly. They open only when something goes wrong.

★ ***Give Thermal Protection to Panelboards and Switches.***

The thermal cutout in the Fusetron will open whenever its temperature reaches 280° F. Thus if poor contact heat develops from any cause the Fusetron cuts off the current before damaging temperatures can be reached. Ordinary fuses can't so protect because the temperature of the link must reach 786° F. before it will melt out.

With Fusetrons you are warned that a minor maintenance job is needed instead of having panel or switch damaged or destroyed by poor contact.

★ ***Prevent needless blows caused by heating in panels and switches.***

Ordinary fuses have 55 to 140% greater electrical resistance at full load than Fusetrons, hence Fusetrons produce less heat and thus eliminate useless shutdown troubles caused by fuses running too hot in panelboards and switches.

★ ***Permit use of larger motor or adding more motors on circuit without installing larger switch or panel.***

See other page.

★ ***On new installations proper size switches and panels can be used instead of oversize.***

See other page

★ ***Protect motors against burnout.***

On normal installations, Fusetrons used in a size near ampere rating of motor will protect it against burnout from lack of oil, worn bearings, tight belt or anything that causes a dangerous electrical overload—yet their tremendous time-lag keeps them from blowing on motor-starting current.

★ ***Give double burnout protection to large motors.***

Larger motors already equipped with overload protection sometimes burn out due to thermals or relays failing to operate. Replace fuses used for short-circuit protection with Fusetrons of size near motor rating and they will protect motor against burnout from any electrical overload, entirely independent of other overload device.

★ ***Provide simplest way to stop burnouts from single phasing.***

When single phasing occurs, increased current flowing through remaining phase will open Fusetrons (if size used is near normal running current of motor) and shut down motor. Never before has such dependable single phasing protection been available.

★ ***Make burnout protection of small motors simple and inexpensive.***

Small motors have generally been operated without burnout protection because the cost of protecting them has been too great compared to cost of replacing motor. Now for the little cost of installing a Fusetron of proper size, any motor can be given safe, dependable burnout protection.

★ ***Protect coils, transformers and solenoids against burnout.***

Install a proper size Fusetron. It won't open on harmless overloads or normal current surges, yet should a dangerous overload occur for any reason it will cut off the current to prevent a burnout.

FUSETRONS

Sold Through Wholesalers

548

Bussmann Mfg. Co., University at Jefferson
St. Louis 7, Mo. (Division McGraw Electric Co.)

Please send me complete facts about BUSS Fusetrons.

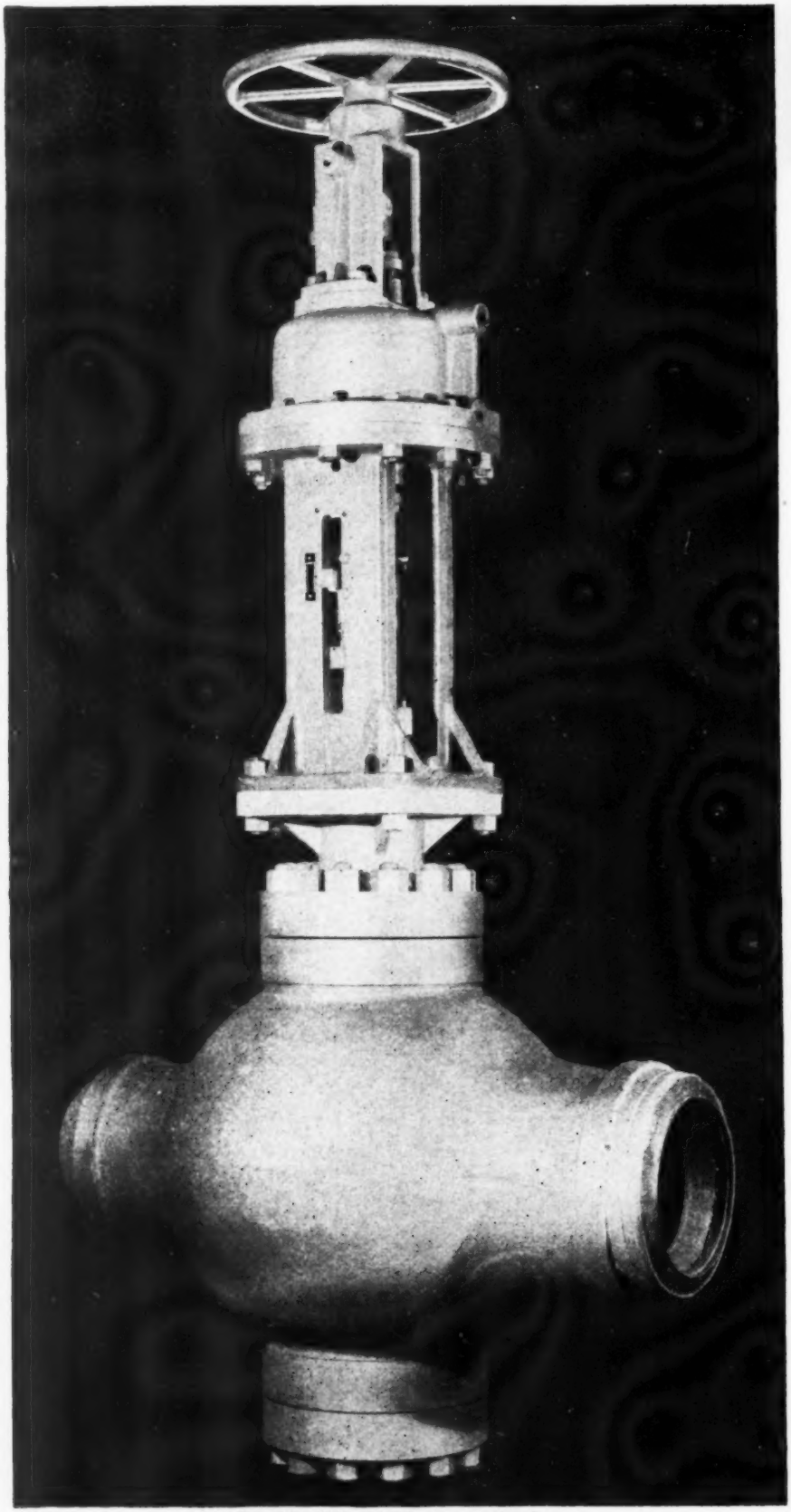
Name_____

Title_____

Company_____

Address_____

City_____ State_____

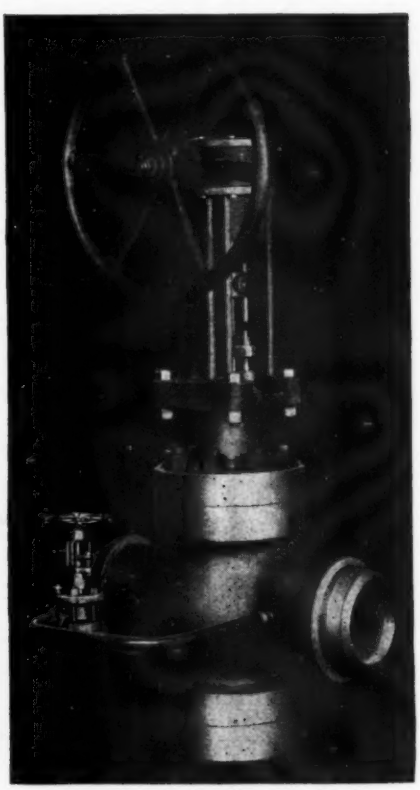


Republic 12 in. cylinder operated valve

REPUBLIC

GENERAL SPECIFICATIONS

- Built in all pressure standards—both flanged and welded ends.
- Streamlined flow through parts virtually eliminates erosion.
- Single seated valves—guaranteed drop tight.
- Double seated valves—guaranteed maximum leakage less than 1/2%.
- Steam valves have heat treated stainless steel trim with screwed in seats.
- Water valves have welded in seat rings with hard surface overlay—on small valves overlay is made directly on body.
- All valves are engineered to the job or application.



Republic 6 in. hand operated valve

REPUBLIC FLOW METERS CO.

VALVES REPUBLIC

Regulating — Pressure Reducing — Shutoff

CYLINDER OPERATED—double seated

Republic cylinder operated valves are of the gradual opening, high lift, double seated type. They are hydraulicly operated to assure smooth performance at any speed regardless of size, static pressure or pressure reduction. These valves are available in sizes from 3″ to 24″, with or without hand operating wheel. Due to compact design, a regulator may be mounted directly on the valve.

HAND OPERATED—large sizes

Republic hand operated valves, in sizes from 3″ to 8″, are built to 900 lb. and 1500 lb. pressure standards. They are of the single seated type, have a one piece valve stem, and seat rings that are Stellite surfaced and welded in place. The gear reduction head is built with ball or roller bearings and precision ground gears for minimum friction and back lash. These valves are recommended for flow control and shutoff applications.

HAND OPERATED—small sizes

Republic single seated hand operated valves are also available in 1″, 1½″ and 2″ sizes, built to 600 lb., 900 lb. and 1500 lb. pressure standards. These valves also have a one piece valve stem, and a Stellite surfaced seat integral with the valve body.

LEVER OPERATED—large sizes

Republic double seated lever operated valves are ideal for air actuation with long stroke cylinders. They are available in sizes from 3″ to 16″ for low pressure applications and in sizes up to 6″ for 1500 lb. applications. The lever mechanism, of sturdy construction capable of taking full strains of power cylinders, is adjustable with full cylinder stroke to change valve capacity.

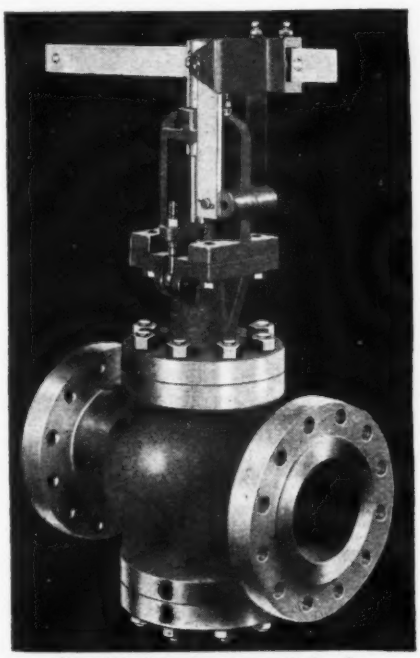
LEVER OPERATED—small sizes

Republic single seated lever operated valves are available in sizes up to 2″ and for pressures up to 1500 lb. standard. The valve seat is Stellite surfaced and integral with the valve body. The sturdy lever mechanism is adjustable for lift. Many of these valves are in operation on water lines with over 1000 lbs. pressure reduction.

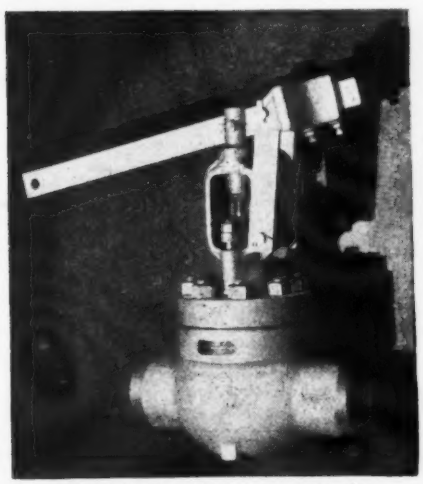
BUTTERFLY VALVES

Republic butterfly valves can be supplied in cast iron or steel for pressures up to 300 lbs. Vanes can be supplied of the angle seating or swing through types. The shaft can be mounted on ball or plain bearings as required. A valve operator may be mounted directly on valves of 6″ size and over.

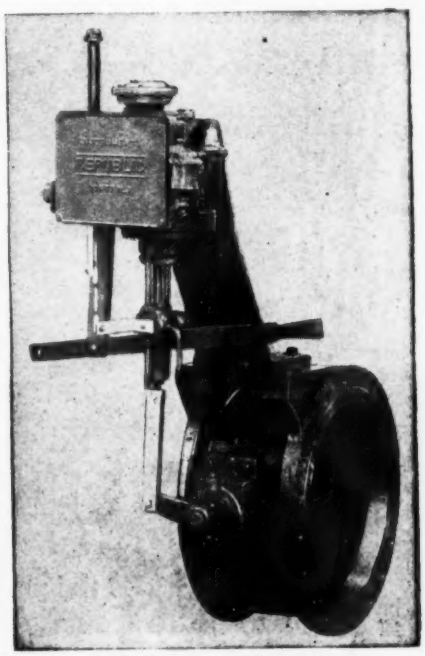
All Republic valves are engineered to the specific job on which they are to be used. Our engineers will be glad to consult with you on any of your valve problems. Write, asking to have one of our engineers call.



Republic 6 in. lever operated valve



Republic 2 in. lever operated valve



Butterfly valve with operator

2240 Diversey Pkwy., Chicago 47, Illinois

ANNOUNCING THE *Modine* UNIT

HERE TODAY..A Complete Line of the most Beautiful Unit Heaters Ever Developed!

HORIZONTAL DELIVERY

23 Models The most popular type of Unit Heater ever built for general industrial and commercial applications. This is the type with the well-known Modine patented center location of supply and return connections which provides direct-from-pipe-line suspension . . . for low cost, fast installation.

VERTICAL DELIVERY

16 Models Designed for overhead installation, new Modine Vertical Delivery types can be located up near the ceilings of high bays to clear production equipment and crane ways —or at low levels as in stores and offices. Delivers large volumes of air at high velocity and comfortable temperatures directly downward.

NOW
control heat distribution as easily as you control light

Notice the wide range of heat-throw

GREAT NEW 1947 HEATER LINE

Three Distinct Types..to Meet the Challenge of Today's Complex Heatinq Requirements!

HERE'S a new line of Modine Unit Heaters designed to meet practically every space heating need of modern industrial and commercial buildings. Modine now gives you three separate and distinct types, developed as a matching, integrated line with 47 basic capacities. Never before has propeller unit heater design been so closely adapted to the expanding applications of unit heating . . . or to the critical requirements of unit heater application engineers.

Strikingly attractive appearance — a result of modern styling and beautiful color treatment of all models, opens a broad new range of installation opportunities. Units are finished in biege-gray enamel with sparkling polished chrome trim.

Advanced design features improve heating performance . . . lengthen service life . . . offer greater versatility of application. If you're planning to build a new plant or store, investigate the Modine line. For complete information, see the "Where-To-Buy It" Section of your phone book, or send in the coupon below.

Modine
UNIT HEATERS

NEW POWER-THROW

8 Models . . . A revolutionary new type of horizontal delivery unit heater designed for specialized industrial applications. Where machinery or other plant equipment impede air delivery of standard units, the powerful, scouring, jet action of the Power-Throw is ideal for providing the desired penetration.

patterns available!

MODINE MANUFACTURING COMPANY
1830 Racine Street
Racine, Wisconsin

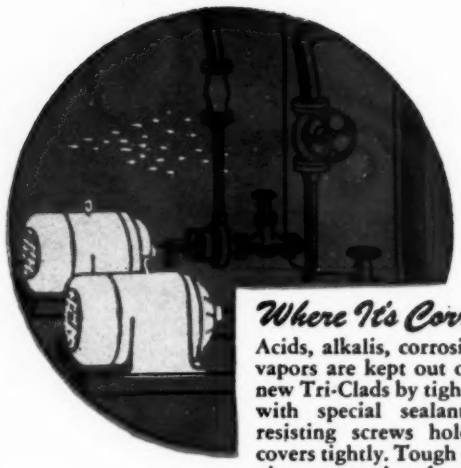
Gentlemen: Yes! I want all the facts about the great, new 1947 Modine Unit Heater Line. Please send me complete information.

Name.....
Position.....
Company.....
Street..... State.....
City.....

FOR TODAY'S *Tougher Jobs...*

Where It's Wet

Even the toughest, wettest weather doesn't bother the new totally enclosed Tri-Clad motors. Cast-iron end shields are machined to provide a tight seal. Motor leads are sealed in a nonshrinking compound. Long, close-running fits, and a rotating labyrinth seal, keep moisture from entering the motor along the shaft.



Where It's Corrosive

Acids, alkalis, corrosive fumes, and vapors are kept out of these sturdy new Tri-Clads by tight joints treated with special sealants. Corrosion-resisting screws hold conduit-box covers tightly. Tough Glyptal* paint gives protection from corrosion.

Where It's Dirty

Dirt and dust that cut motor efficiency and shorten motor life can't get into these sealed, totally enclosed Tri-Clad motors. Smooth easy-to-clean surfaces and rounded contours enable these Tri-Clads to look good even in dirty surroundings.

Where Iron Dust Flies

Harmful iron dust and metallic filings can't get past the inner wall of these new Tri-Clads. Bearings are safe from gritty dust in cast-iron housings cast integral with end shields. Long, close-running fits and a rotating labyrinth seal stop dust infiltration along the shaft.

Where Space Is Tight

When space is limited for a totally enclosed motor, you'll appreciate the trim, extra compactness of the new Tri-Clads. A diagonally split conduit box, mounted on either side of the frame, adds little to over-all motor width. These motors do a big job in a little space.

Where Explosion Hazards Exist

The new Tri-Clad totally enclosed motor is available in explosion-proof and dust-explosion-proof constructions with special features that make it suitable for Class I, Group C (through 15 hp) and Group D, and Class II, Groups E, F, and G, locations. All sizes tested and listed by Underwriters' Laboratories, Inc. Also in Bureau of Mines construction (Schedule 2E).

HERE'S A NEW *Tougher Motor*

THE G-E TRI CLAD TOTALLY ENCLOSED MOTOR

1 to 1000 Hp

Enthusiastic reception of the Tri-Clad open motor, with its *extra protection* features, proved that industry was waiting for a motor with protection built in. And, since 1940, more Tri-Clad motors have gone into service than any other integral-horsepower motor.

Now General Electric is ready with a new line of Tri-Clad motors—totally-enclosed, fan-cooled motors—the toughest motors we've ever built.

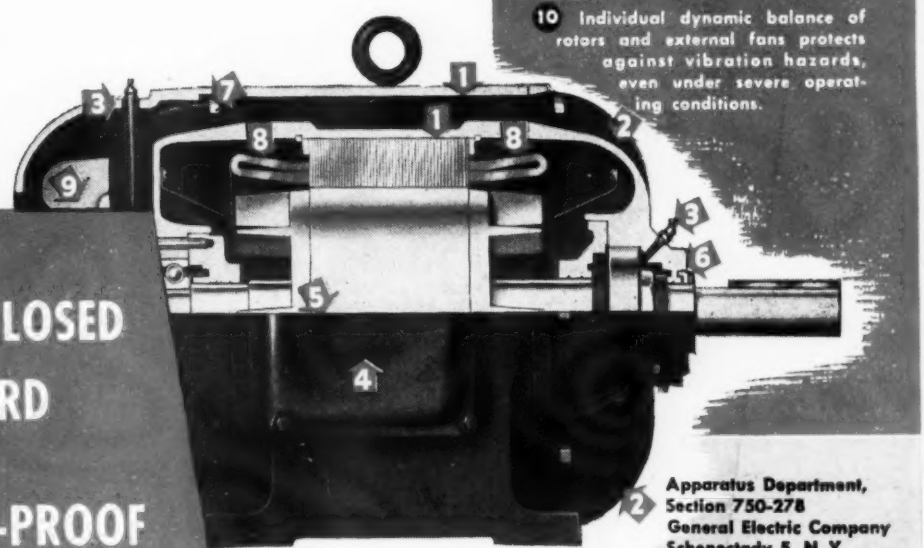
These new Tri-Clads are designed and built specifically for use in many adverse atmospheres—in iron dust, out of doors, in hazardous areas, and chemical atmospheres. *We believe that they are industry's most dependable motors.*

Their scope of application is as wide as the field of industrial motor use. Safeguarded against most sources of motor damage, their longer life and lower maintenance will make them a sound investment on almost every job.

**Trade-mark Reg. U.S. Pat. Off.*

10-POINT PROTECTION

1. A cast-iron, double-wall frame completely encloses and protects the windings and punchings.
2. Corrosion-resistant cast-iron end shields are machined to provide a tight seal, and protect the motor from dust, dirt, and moisture. Primer and finish coat of protective Glyptal affords high rust-resistance.
3. A pressure-relief greasing system, which can be packed with long-life lubricant, protects the bearings.
4. The cast-iron conduit box is diagonally split for easy wiring. Boxes are independently explosion-proof on Class I motors.
5. Nonshrinking compound around motor leads protects motor interiors from dust and moisture at the point where leads pass through the frame.
6. Rotating labyrinth seal further protects motor interior from damage by foreign matter.
7. Large air passages provide adequate protection from overheating. Easy to keep clean and open, too.
8. Modern, "ageless" insulation treatment includes windings of Formex* magnet wire.
9. Removable external fan is of the nonsparking type in explosion-proof motors.
10. Individual dynamic balance of rotors and external fans protects against vibration hazards, even under severe operating conditions.



TOTALLY ENCLOSED STANDARD and EXPLOSION-PROOF MOTORS

FOR THE COMPLETE STORY

GENERAL ELECTRIC

750-278-8080

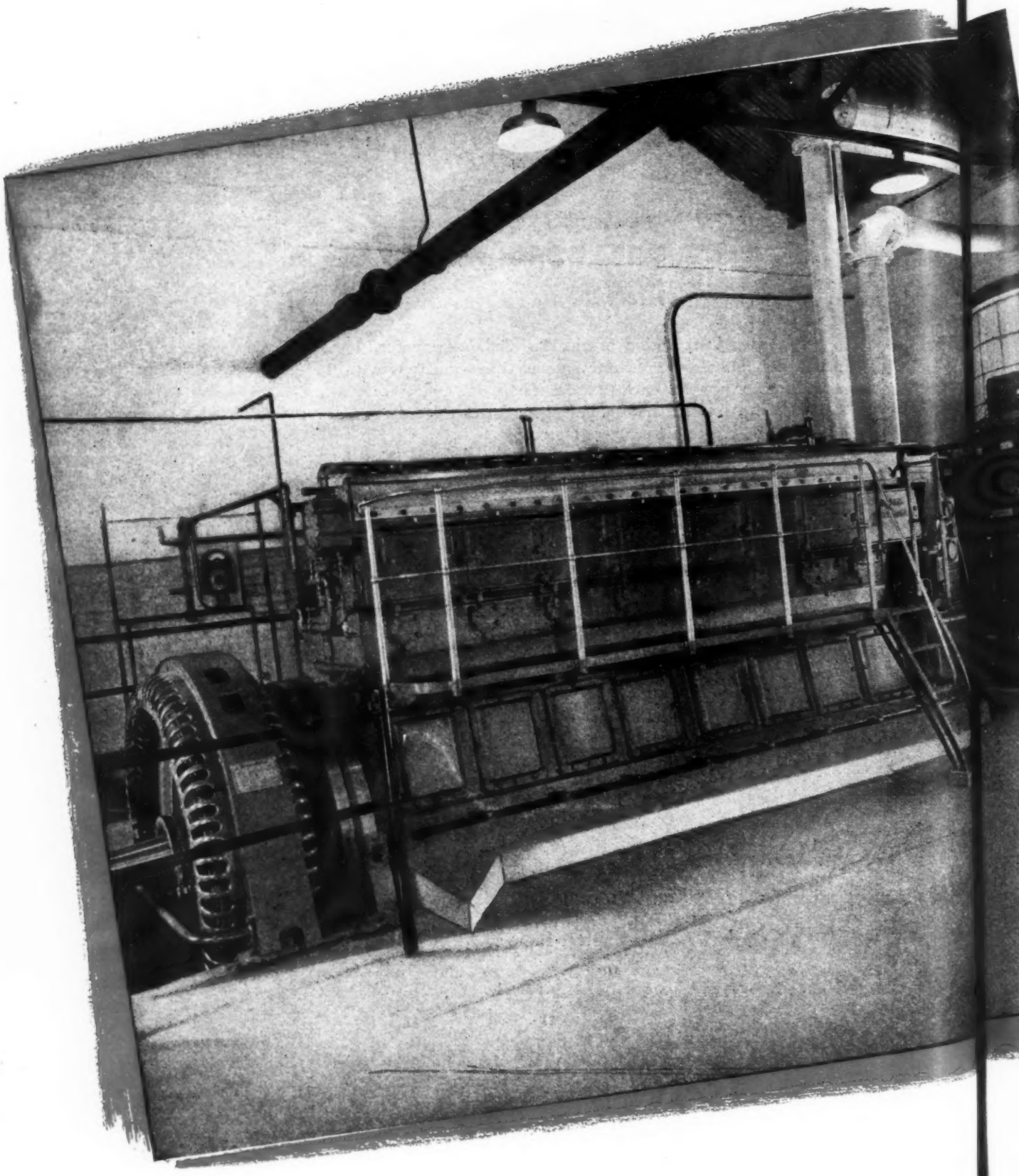
Apparatus Department, Section 750-278
General Electric Company
Schenectady 5, N. Y.

Please send me GEA-4400, which describes the new Tri-Clad totally enclosed motors. Please send me GEA-4141, "Motors and Control for Hazardous Locations."

NAME.....

COMPANY.....

ADDRESS.....



TUNE IN THE
TEXACO STAR THEATRE
WITH JAMES MELTON
EVERY SUNDAY NIGHT—CBS

TEXACO

TEXACO

EFFICIENCY GOES UP

COSTS GO DOWN

EFFICIENCY goes *up*—fuel and maintenance costs go *down*—when you lubricate your Diesels with *Texaco Ursa Oils.* These famous oils keep engines *clean*—assuring lively valve action, free rings and proper seal, less wear of pistons, rings, liners and bearings. Their use means steady, full-power output with minimum expense for fuel and maintenance.

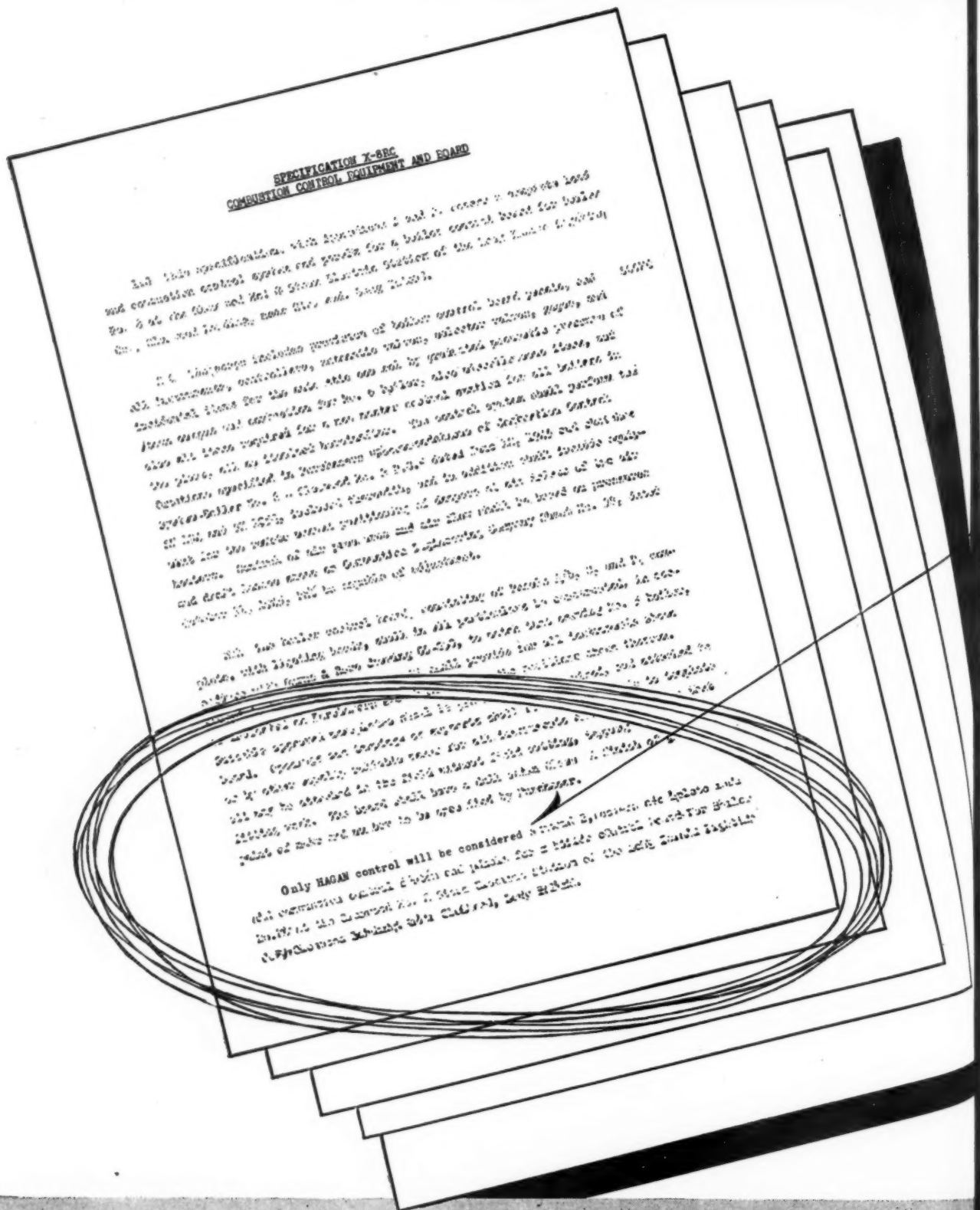
Texaco Ursa Oils come in a complete line to assure the most effective lubrication of every type and size of Diesel. They are approved by all leading Diesel engine manufacturers, and are preferred by operators everywhere. In fact—

More stationary Diesel hp. in the U. S. is lubricated with Texaco than with any other brand.

For Texaco Products and Lubrication Engineering Service, call the nearest of the more than 2300 Texaco distributing plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, N. Y.

URSA OILS

FOR ALL DIESEL ENGINES



HAGAN *Automatic* COMBUSTION CONTROL

The pioneer . . . and still the leader

"Only HAGAN control will be considered"

Specifications for an automatic combustion control system for a small steam plant in a Southern state, which came to us a short time ago, included this sentence—"Only Hagan Control will be considered."

As far as we could learn, the purchaser had no previous experience with Hagan Automatic Combustion Control, so we set out to learn the reason for the confidence implied by that flat statement.

It was due, we discovered, to the representative of the stoker manufacturer! His observation of hundreds of plants in which his company's stokers were installed had shown him that fuel consumption was lower when Hagan Control was used.

Naturally he wanted his stokers to give the best possible performance, so he had formed the habit of recommending Hagan Control whenever opportunity offered.

He had found that Hagan gave excellent results in small plants as well as large, for the Hagan equipment in all plants meets exactly the same standards of design and construction. The lower cost of the small plant systems is achieved by simplifying the system, eliminating refinements that are not required for adequate regulation of smaller boilers.

This simplification is facilitated by the fact that all Hagan Automatic Combustion Control systems are based on the principle that *control* and *metering* are separate functions. With Hagan control, combustion conditions are set up by the control system; meters merely show what is happening.

If you want more efficient boiler operation and lower fuel consumption, arrange to have a Hagan engineer visit your plant. He will be glad to survey it and make recommendations, without any obligation on your part.

HAGAN CORPORATION, HAGAN BUILDING, PITTSBURGH 30, PA.

HAGAN
HALL
BUROMIN
CALGON

Sturtevant Mechanical Draft Fans Help Supply

Here's why the Sturtevant E-R Wheel lasts 2 to 4 times longer

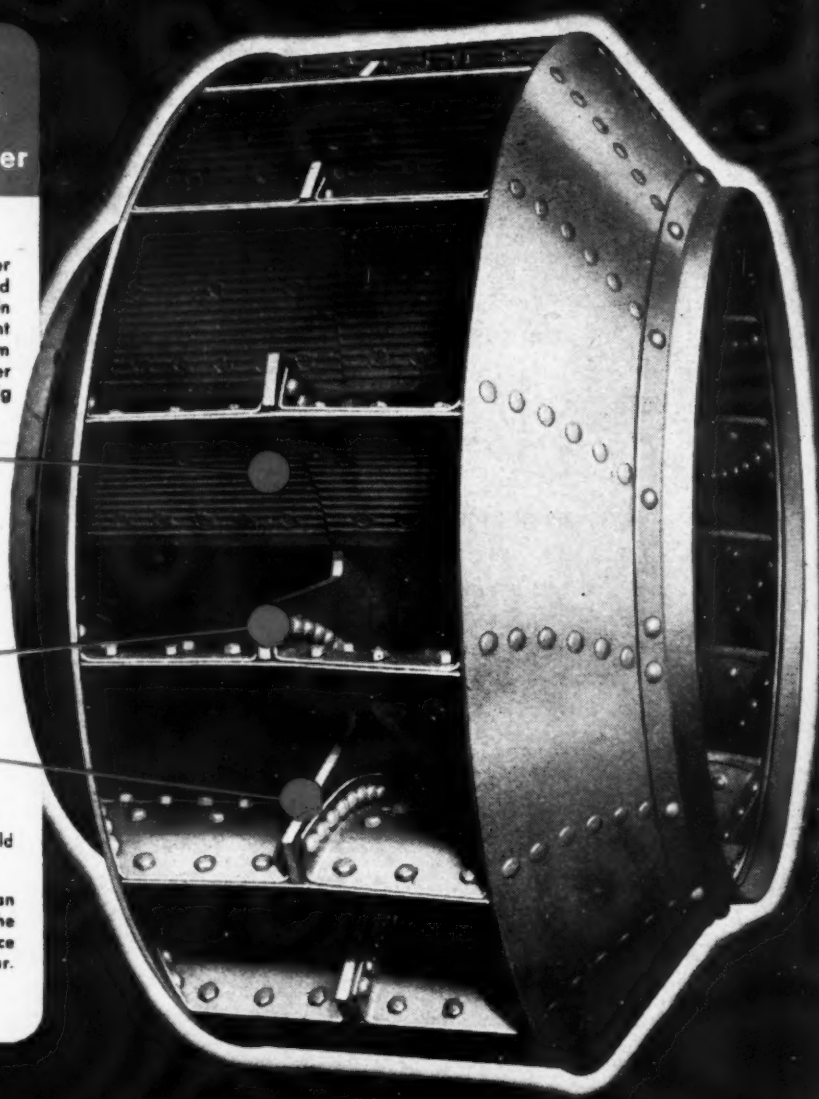
Fly ash that eats into blades and center plate limits the life of ordinary induced draft fans to just a few months. But in one plant after another, the Sturtevant Erosion-Resisting wheel shows minimum wear—and no loss of efficiency after years of service. Here are three big reasons why:

1. These special ribbed liners armor your wheel against the abrasive action of fly ash. Instead of renewing a whole wheel, all you do is replace these liners—easily, quickly, at much lower cost. That means savings in maintenance time, labor and outage losses.

2. Blades are continuous—without a dividing center plate—offer no obstruction to the smooth flow of fly ash.

3. Concentrated streams of fly ash from each inlet attack each other—*not the wheel*—because the center plate is cut away between blades, giving fly ash no toe-hold to start its destructive work.

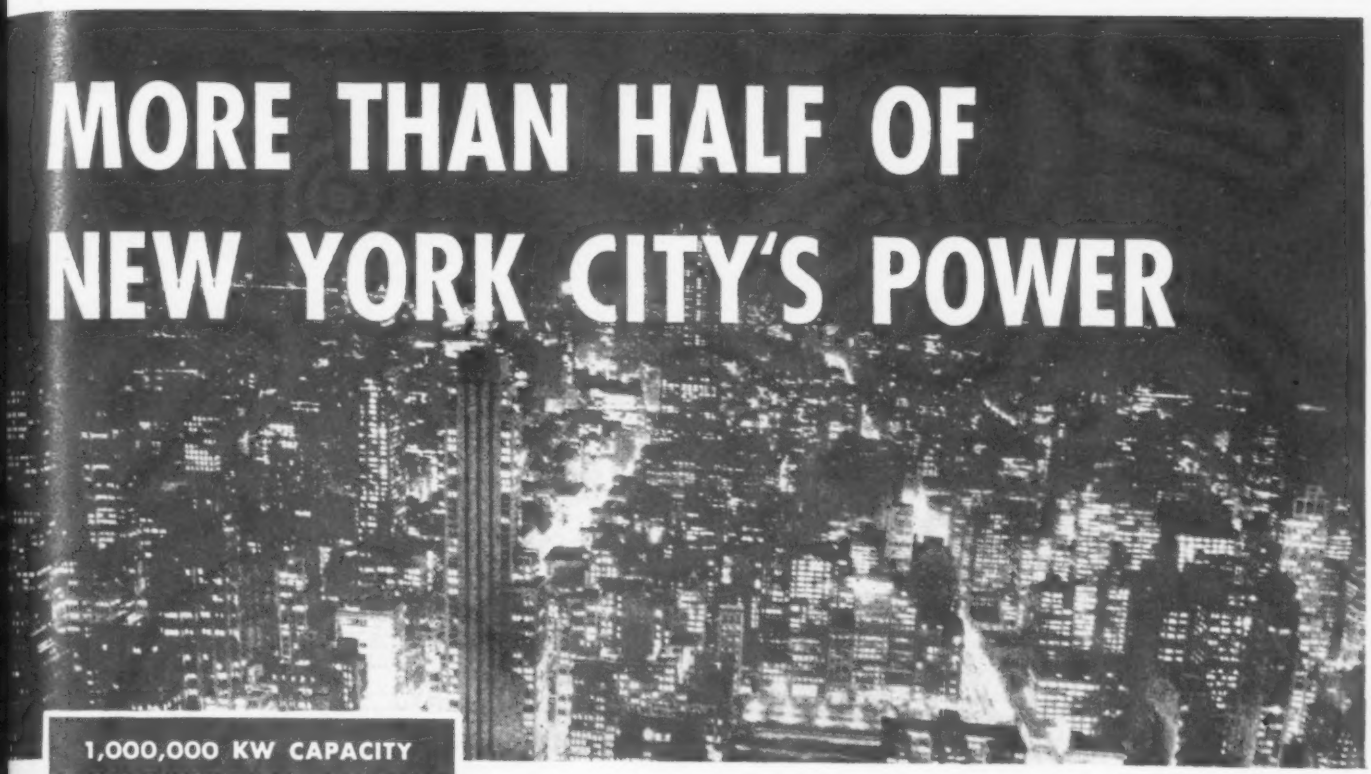
If it's longer service you want from an induced draft wheel, plan on using the Sturtevant E-R wheel when you replace your present equipment. Write for further details now.



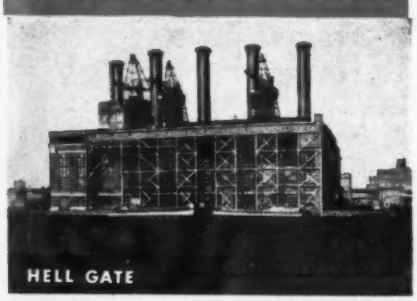
HEATING • VENTILATING • AIR CONDITIONING •

DRYING • DUST AND FUME CONTROL • CONVEYING

MORE THAN HALF OF NEW YORK CITY'S POWER



1,000,000 KW CAPACITY FROM THESE THREE STATIONS



HELL GATE

HUDSON AVENUE

EAST RIVER

3 Power Plants in Consolidated Edison System Now Use Long-Life E-R Wheel in 45 TVID Fans

More than half the daily power requirements of the world's largest city is supplied by three generating plants of Consolidated Edison Company of New York. And in all three there are Sturtevant Turbovane Induced Draft Fans, equipped with the Sturtevant Erosion Resisting wheel . . . 32 at Hudson Avenue Station, 6 more at East River and 7 at Hell Gate.

In one city after another . . . in the largest and smallest power plants alike . . . Sturtevant Mechanical Draft equipment is rendering outstanding service. For full details, write: the Sturtevant Branch Office nearest you, or: B. F. STURTEVANT COMPANY, *Division of Westinghouse Electric,* Hyde Park, Boston 36, Massachusetts.

DID YOU KNOW that, by pooling resources with Westinghouse Electric, Sturtevant now offers the most complete line of air handling equipment ever available from a single manufacturing source? To the power plant operator, that means undivided responsibility for the complete system . . . one engineering headquarters for all component parts . . . service facilities everywhere . . . and important cost savings from buying the complete system in one package.

3653-30

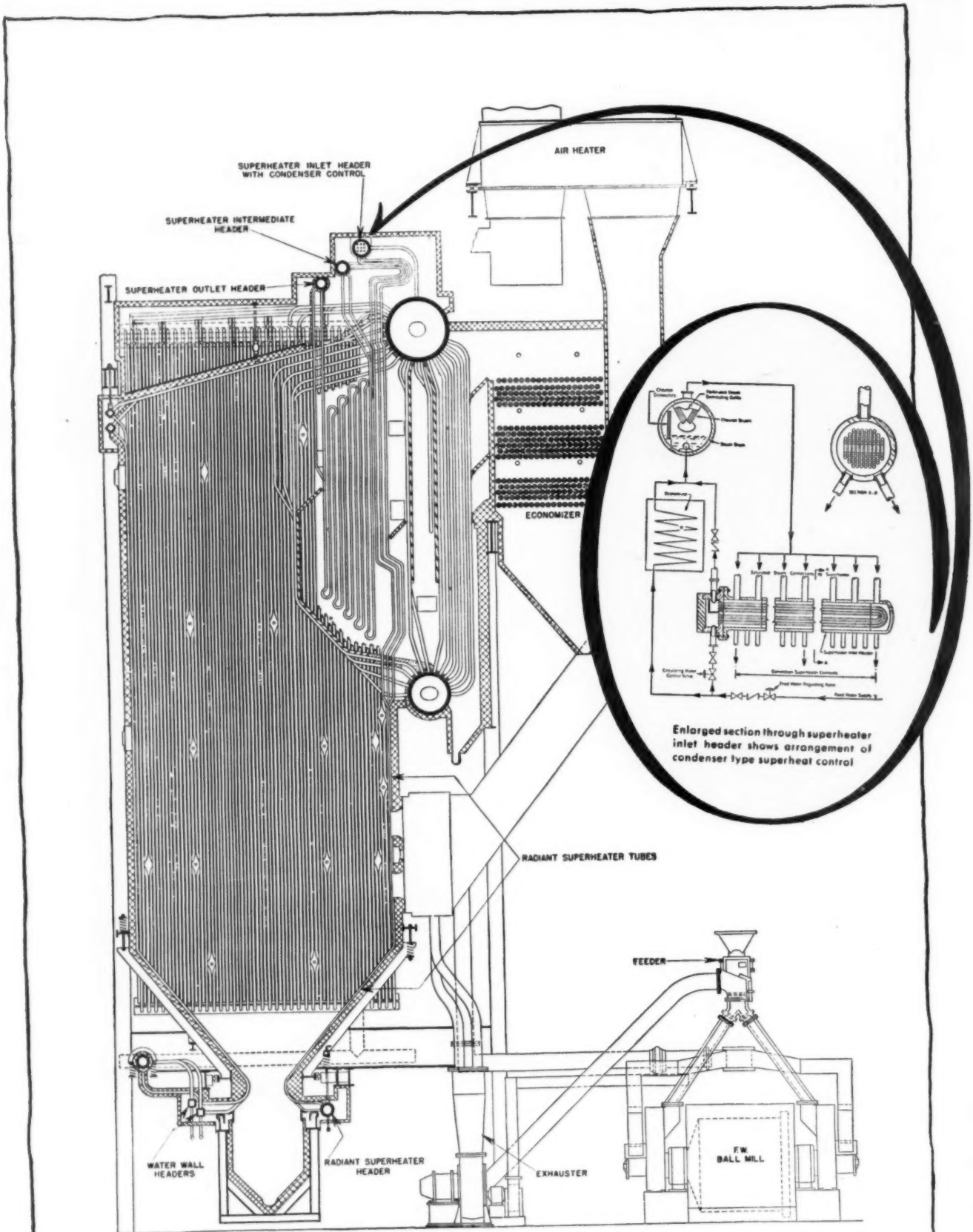
Sturtevant
REG. U. S. PAT. OFF.
Puts Air to Work

B. F. STURTEVANT COMPANY • DIVISION OF
Westinghouse
ELECTRIC

PRECIPITRON

MECHANICAL DRAFT

MISSOURI AVENUE—



MISSOURI AVENUE STATION, ATLANTIC CITY ELECTRIC CO.

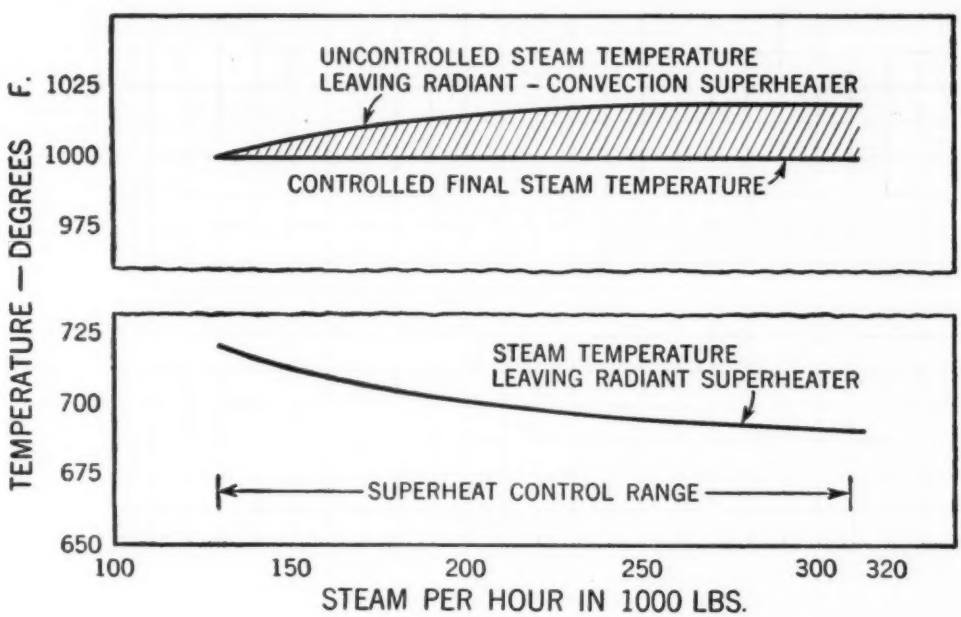
superheat control *maintains steady 1000°F* over wide load range

The first public utility steam generator designed for 1000 deg. F. final steam temperature, controlled over a wide load range, goes into service this fall at the Missouri Avenue plant of the Atlantic City Electric Company.

Complementary characteristics of radiant and convection superheater sections combine to yield an almost constant final steam temperature from 130,000 to 310,000 lb. per hour of steam. As the load varies over this range the uncontrolled steam temperature varies from 1000 deg. to 1020 deg. F. With the addition of condenser type control, superheat is maintained steadily at 1000 deg. over 58% of the load range.

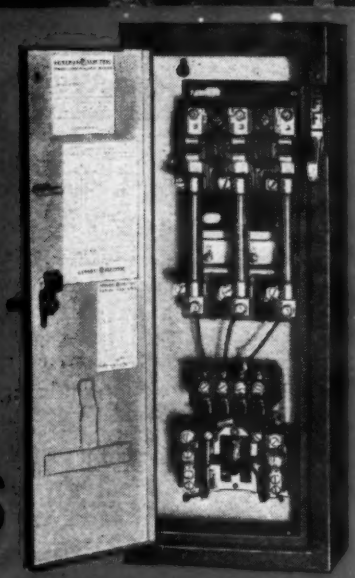
Condenser type control introduces moisture at the superheater inlet header without adding water. Boiler water circulating through coils in the superheater inlet header condenses a portion of the entering steam, automatically regulating the amount of moisture entering the superheater. Positive and accurate control of final temperature is obtained, possible contamination of the steam is eliminated and excessive metal stresses due to temperature differences avoided.

FOSTER WHEELER CORPORATION • 165 BROADWAY, NEW YORK 6, N. Y.



FOSTER WHEELER

Sacking the seeds, one of the many processes controlled by G-E combination starters at the Rohnert plant



59 G-E COMBINATION STARTERS Control the Processing of 1/4 of the World's Vegetable Seeds

COMBINATION STARTERS SAVE TIME, SPACE, AND MONEY

Every process from eliminating dirt and debris to sorting the seed to size is controlled by G-E combination starters at the Waldo Rohnert Co., world's largest producers of garden vegetable seed.

In their four-story plant, completed in 1944, and said to be the most modern of its kind in the country, ¼ of the world's garden vegetable seed is processed—that's far more than a million pounds of clean seed a year. All electrical, it boasts 59 General Electric CR7008 combination starters and supplementary control which regulate the five separate seed mills of their complicated seed mill system.

According to Fred Rohnert, son of the founder, *"Our G-E controls and equipment have proved extremely satisfactory. They've given us no trouble since their installation."*

And here's why these starters have proved so satisfactory—

COMBINATION STARTERS SAVE TIME—

In addition to the time saved in ordering, outstanding savings in installation time are made with these starters. Users report a 50 per-cent reduction in mounting time, a 40 per-cent reduction in wiring time, as compared with the installation of two separate devices. You connect to only 9 terminals instead of 15.

SPACE—

Valuable wall space is saved because combination starters can be installed in small, unused places either near to or remote from the operator.

AND MONEY—

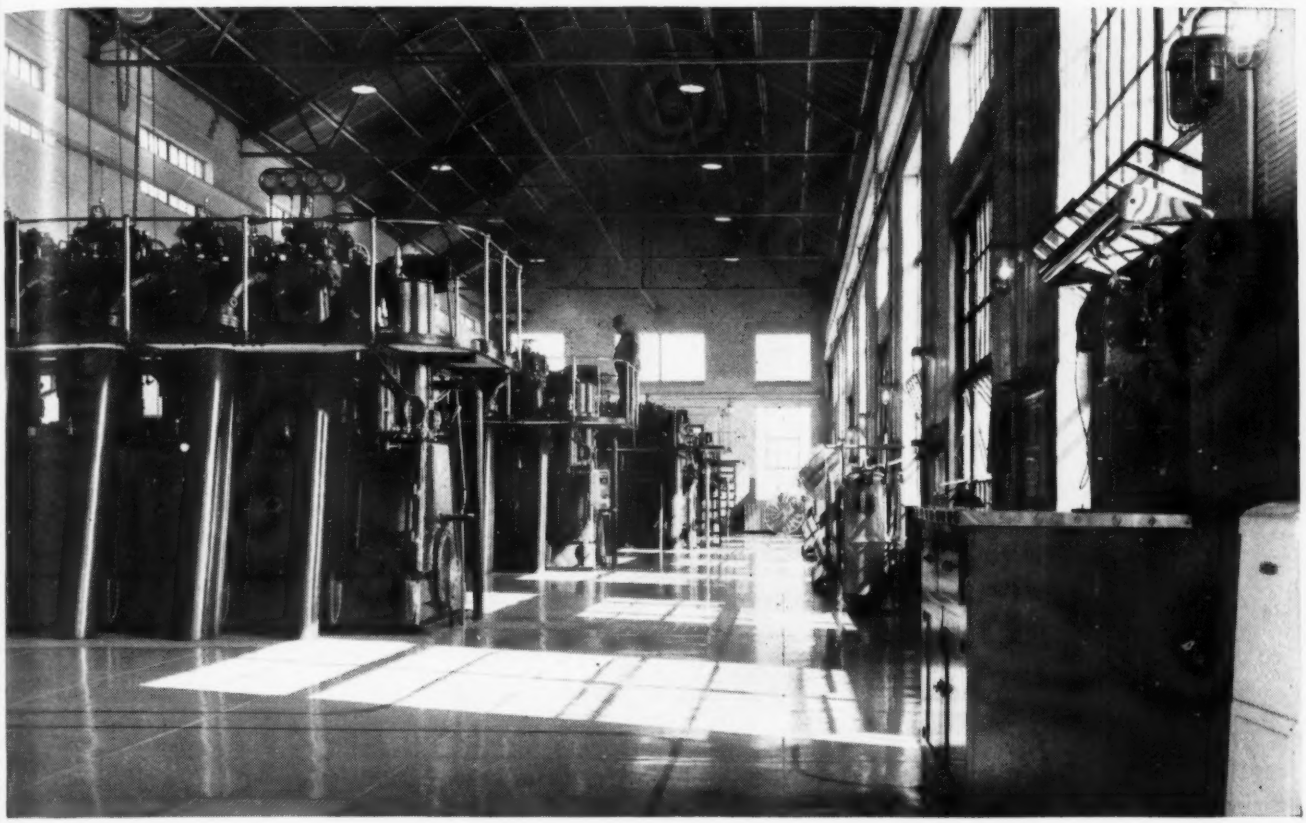
While the list price is slightly higher than for two separate devices, the difference is more than made up by savings in wire, fittings, and time.

WHAT IS YOUR APPLICATION?

Combination starters come in a variety of enclosures to meet any operating condition in your plant. If you'd like more information, ask our nearest office for Bulletin GEA-2715A. And remember, our engineers will be glad to help you with your application. ***Apparatus Dept., General Electric Co., Schenectady 5, N. Y.***

GENERAL ELECTRIC

676-201-8910



Learn how low low-cost Diesel power can be

YOU CHOSE DIESELS for power because of their inherent low cost operation. You probably made this choice long before modern, heavy duty Diesel oil was available. Even then, in spite of periodic cleaning and overhauling that was needed, power costs were low. Now, with Nonpareil HD Diesel Oil, you have an opportunity to further lower costs. You can lengthen the time between inspections, and the amount of cleaning and replacements needed will be less even with the longer periods of operation. It is not unusual for operators to find half the normal cylinder wear after a year's operation on Nonpareil HD. Low wear, unusual cleanliness, few shutdowns and repairs with Nonpareil HD will give you a new measure of how low low-cost Diesel power can be. Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois

NONPAREIL HD
DIESEL OIL

STANDARD OIL COMPANY (INDIANA) STANDARD SERVICE

Where large gears need special protection use . . .

CALUMET
Viscous Lubricants

DUST AND GRIT, heavy loads, excessive heat or wat are some of the adverse conditions under which o dinary gear shields cannot give adequate protectio Calumet Viscous Lubricants are not the old type gear shield, usually made from residual products petroleum. They are true greases, manufactured fro selected soaps and oils, plus additives, to secure th quality most needed in a modern gear lubricant.

Calumet Viscous Lubricants offer these advantage

1. Give long lasting protection. An additive i Calumet Viscous Lubricants gives them improve wetting ability—that is, the ability to adhere closely t metal. This not only provides a long lasting film, un der ordinary operation, but a film that resists hea and water.

2. Save time in application. Because all grade can be applied without heating, and all except th heaviest grades can be sprayed, Calumet Viscou Lubricants cut application time to the minimum.

3. Reduce throw-off. Because spraying gives smooth, even coating of lubricant, it eliminates apply ing excessive amounts which may drop off before the lubricant is worked into the gears. Good wetting abil ity prevents throw-off during operation.

Let this wear-reducing, time-saving lubricant pro tect open gears on all types of equipment. A Standard Oil Lubrication Engineer will survey your plant and help determine the grades you need and the most economical method of application.

Write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.

STANDARD OIL COMPANY (INDIANA)

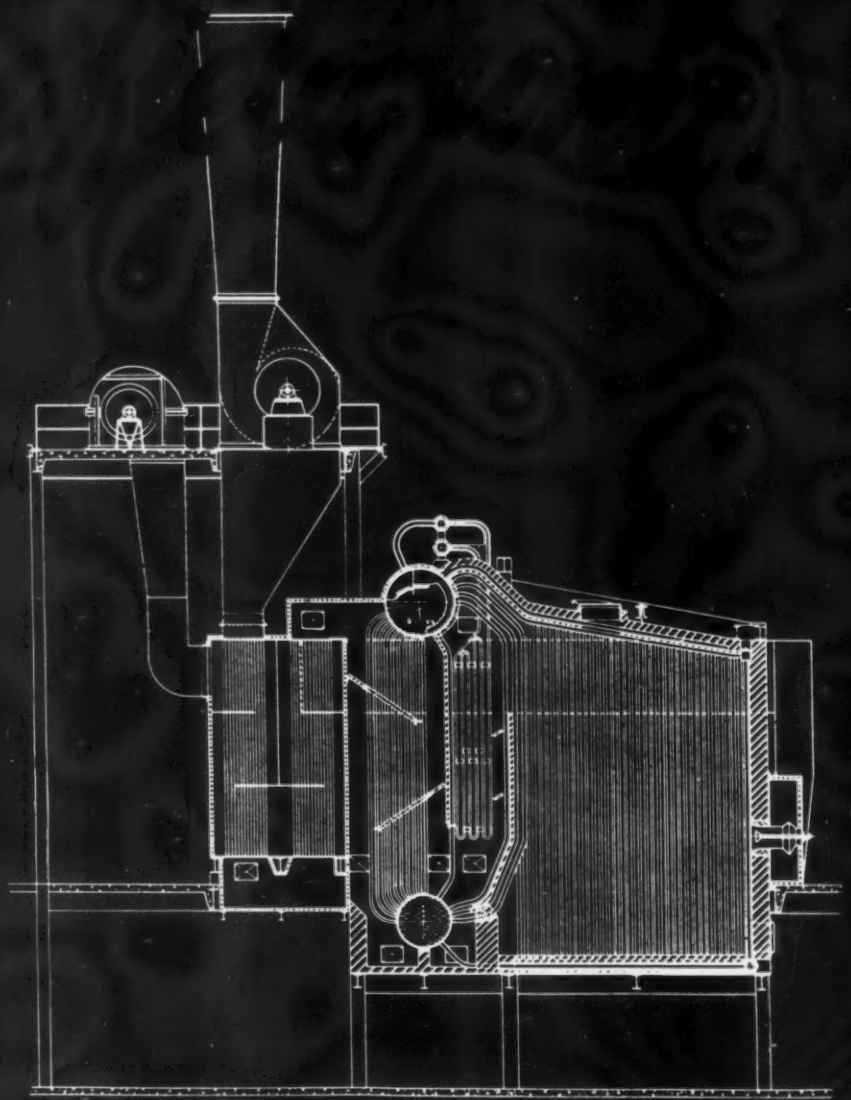
STANDARD SERVICE

a Spri

for City of
Brownsville, Texas

BLACK & VEATCH
KANSAS CITY, MO.
Consulting Engineers

R. G. HALL
City Engineer



Another Springfield steam generating unit! Purchased for the City of Brownsville, Texas, southernmost municipal plant in the United States, it will produce 90,000 lbs. of steam per hour at 420 p.s.i. and 750° F. Designed for 82% efficiency with natural gas, the plant will operate in the open with housing structure to be added later when building construction conditions permit.

Springfield offers a wide range of modern steam generators for power, process, and heating service. Springfield service includes design, fabrication and erection of units complete with firing, draft, and control equipment—all taken on a "Single Responsibility" contract. We will be glad to submit a proposal covering your requirements. SPRINGFIELD BOILER CO., 1953 E. Capitol Ave., Springfield, Ill., U. S. A.

SPRINGFIELD

STEAM GENERATING UNITS
ANY SIZE — ANY FUEL —
ANY PRESSURE

SPRINGFIELD PRODUCTS

•

SECTIONAL HEADER BOILERS. Specially designed for capacities from 5,000 to 450,000 lbs. per hour and higher. Pressures to 900 lbs.

BENT TUBE STEAM GENERATORS. Modern designs for capacities from 20,000 lbs. and up.

STANDARD BOILERS, TYPE M. Twelve standard sizes to choose from. Low engineering costs. Simplified installation. Quicker delivery.

HEAVY DUTY WATER WALLS. Specialists in water cooled furnaces, including Springfield's divided furnace—center water wall (patented) construction.

SUPERHEATERS. Individually designed to meet the particular requirements of each installation.

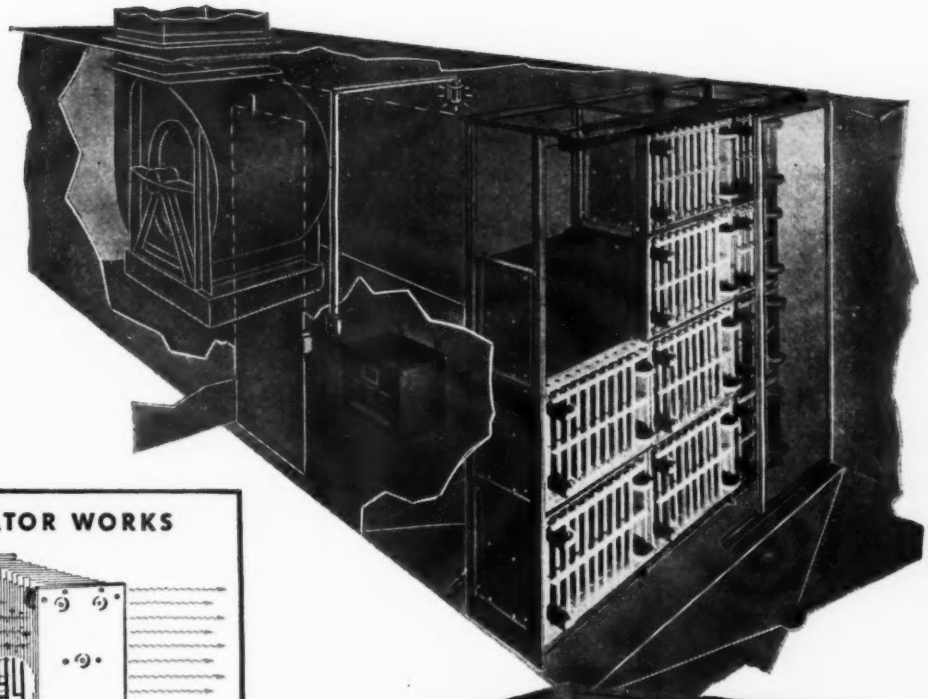
AIR PREHEATERS. Minimum maintenance required. Clean, modern design.

ECONOMIZERS. Built to meet individual requirements.

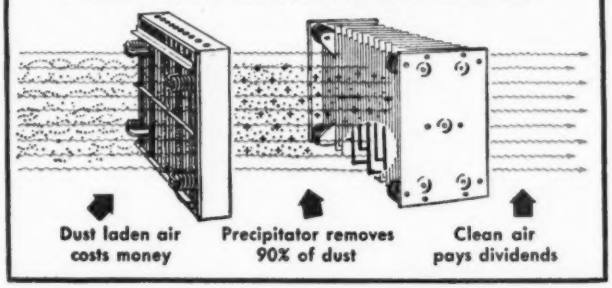
SPRINGFIELD BOILERS

For every place in your plant where dust-free air means a better product, increased output, lower net cost

This *flexible unit* Precipitator comes in cell-units, like building blocks, to provide the exact capacity for any given installation at minimum cost.



HOW THE PRECIPITATOR WORKS

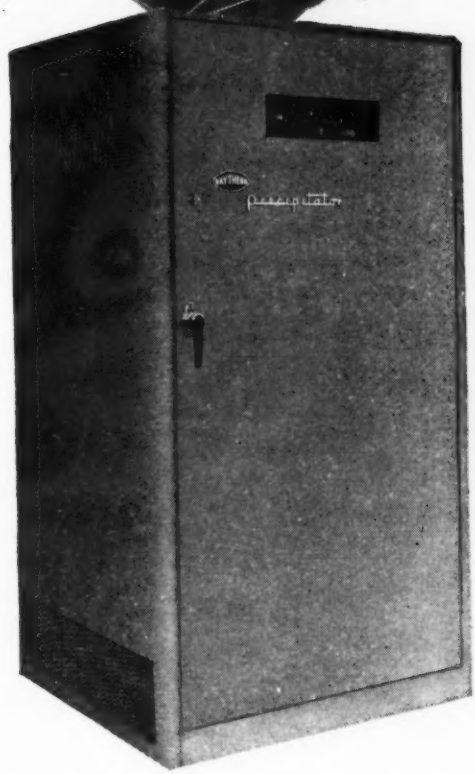


The Raytheon Precipitator comes in neat, portable *Packaged Units* for manufacturing, testing, inspection, laboratory or office areas and in *flexible unit construction* for larger areas. Its ingenious and super-effective electronic screen permits the passage of clean, clear air and *nothing else but!* Dust, oil mist or process particles as infinitesimal as one-250,000th of an inch in diameter are banished forever. Better work, better working conditions, reduced maintenance are assured.

Raytheon electronic engineers have applied their unsurpassed experience and resources to industrial air cleaning, and come up with an efficient, economical, adaptable dust and process particle Precipitator that fits your needs to a "T"

You can put the Raytheon Precipitator to work, right now! Raytheon engineers are ready to supply recommendations and estimates on any or all applications.

Before you invest in air cleaning equipment of any kind, get the story on this new and better Electronic Precipitator and what it will do for you. Write, today, for Bulletin DL-P-503.

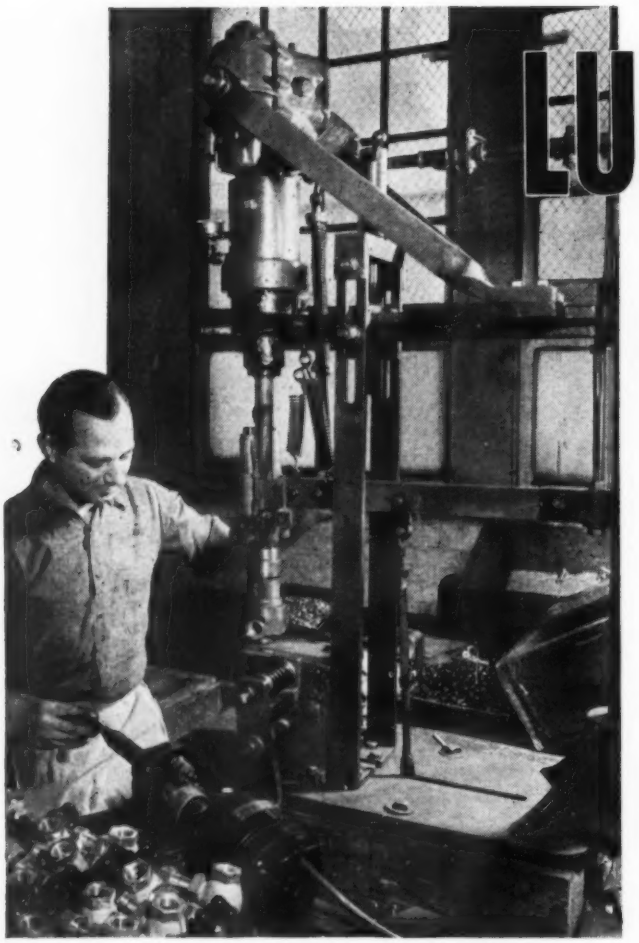


This 1200 C.F.M. Unit — more than four times as efficient as a mechanical filter — removes by recirculation all airborne contamination in a space up to 35 x 35 x 12 ft.

RAYTHEON MANUFACTURING COMPANY
Industrial Electronics Division, Waltham 54, Massachusetts
Builders of Raytherm Dielectric Heaters for every industrial application, Synchronous Controls for Resistance Welding and other Electronic Products for Industry
SALES OFFICES: ATLANTA • BOSTON • CHICAGO • CLEVELAND • LOUISVILLE • NEW YORK

RAYTHEON
Excellence in Electronics

LUNKENHEIMER



ASSEMBLING REQUIRES NO SPECIAL FITTING

● Assembling is greatly simplified by Lunkenheimer precision production . . . parts are so accurately made that special fitting isn't necessary.

Fig. 2125
Bronze
Double Disc
Gate

Fig. 1938
Cast Steel
Gate

Fig. 1430
Iron Body
Gate

Fig. 1640
"King-clip"
Gate

BRONZE, IRON, STEEL AND CORROSION RESISTANT ALLOY VALVES
125 TO 2500 LB. S. P. BOILER MOUNTINGS, LUBRICATING DEVICES
AIRCRAFT FITTINGS

Precision Workmanship

■ ■ ■

SUPER-ACCURACY IN EVERY PART ... LONGER SERVICE LIFE

● You can't fool maintenance men on valve quality. They know that when a valve has a much longer than average service life, that valve has superior accuracy and precision built into it from handwheel to pipe threads.

Such valves are the only kind that have ever been produced by Lunkenheimer. For more than three quarters of a century, the Lunkenheimer quality ideal has won ever widening acceptance until today it is a recognized tradition in American industry.

Lunkenheimer quality is the balanced combination of many factors. Among them are finest raw materials approved by constant testing and research ... sound, advanced design ... highly skilled workmanship...absolute accuracy...perfect alignment of all parts. As an inevitable result—wherever you find Lunkenheimer Valves you find maintenance cost records consistently lower.

The Lunkenheimer Co., Cincinnati 14, Ohio, U. S. A.
Offices: New York 13, Chicago 6, Boston 10, Philadelphia 7.
Export Department: 319-322 Hudson St., New York 13, N. Y.

Your LUNKENHEIMER Distributor

—is an important link in the nationwide Lunkenheimer chain of better, more efficient, more reliable valve service. He is fully equipped to assist in the solution of valve maintenance and operating problems. In addition, he can make prompt arrangements to have a Lunkenheimer Engineer call at the plant whenever technical valve engineering knowledge is required.

Performance

WHERE RESEARCH

EASTERN REGIONAL RESEARCH LABORATORY USES HUNDREDS OF YARWAY IMPULSE STEAM TRAPS ON PILOT PLANT EQUIPMENT

Yes, actually hundreds of Yarways are on the job in this great modern laboratory of the United States Department of Agriculture at Wyndmoor, Pa.

Here research proves new processes . . . and develops new uses for surplus farm crops.

Here, also, as in processing plants from coast to coast, Yarway Impulse Steam Traps prove their worth. These "mighty mites" help get the many pieces of processing equipment hotter, sooner . . . *and keep them hot.*

Yarway's *small size* saves valuable space . . . their *light weight* simplifies installation. Maintenance is reduced because they have only *one moving part*—a simple valve. Also important, Yarway Traps are *suitable for all pressures without change of valve or seat.*

Try one or two yourself . . . that's the best proof. A Mill Supply Dealer near you has them, or write for Catalog T-1739.

YARNALL-WARING COMPANY
100 Mermaid Avenue, Philadelphia 18, Pa.

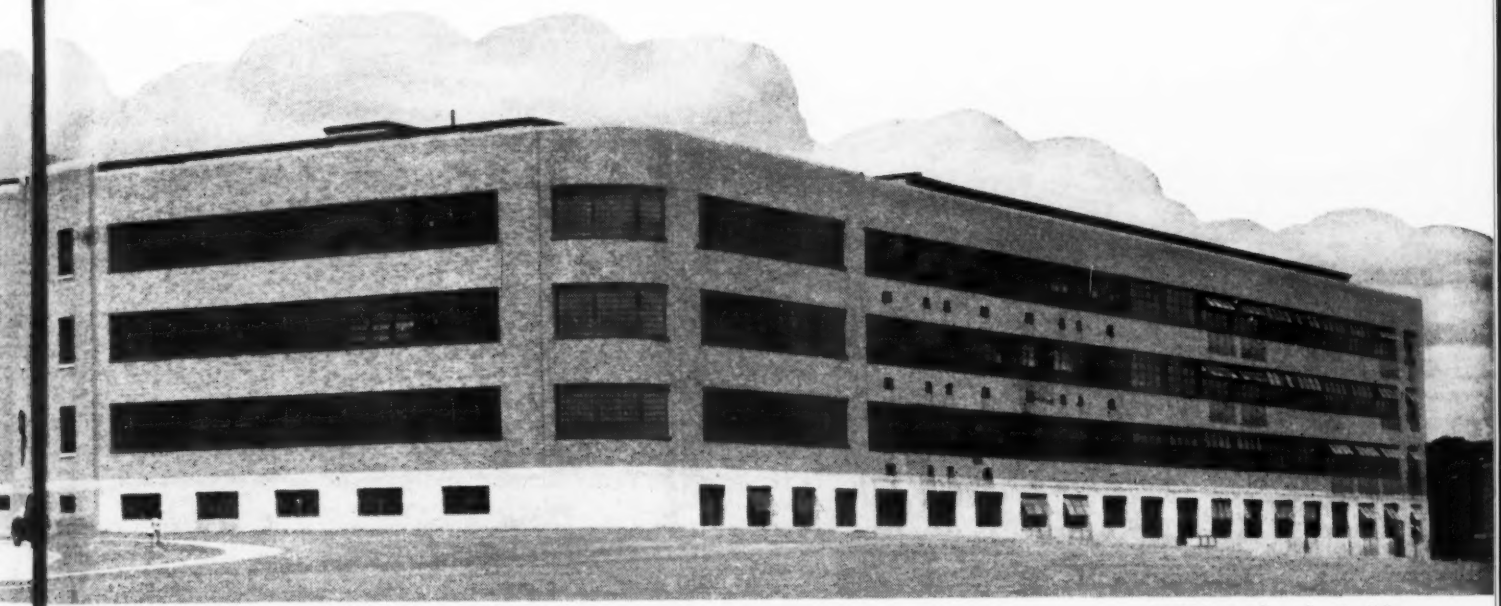
Yarway Impulse Steam Traps are now made and sold in Canada and Great Britain

OVER 450,000 ALREADY SOLD!

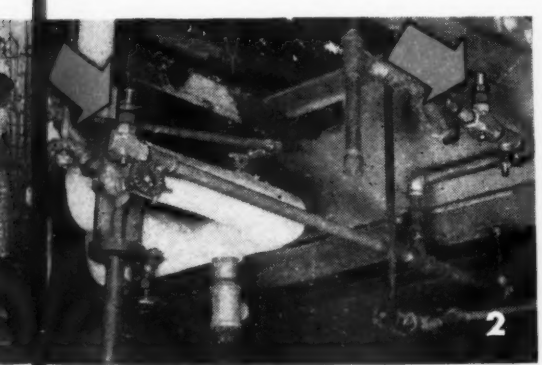
YARWAY

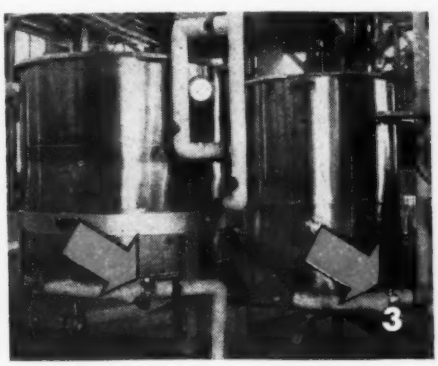
PROVES YARWAY TRAPS

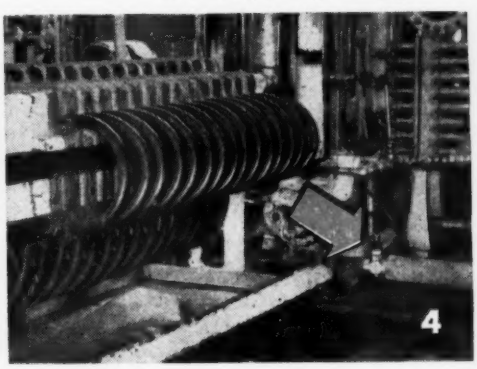
PROVES NEW PROCESSES...



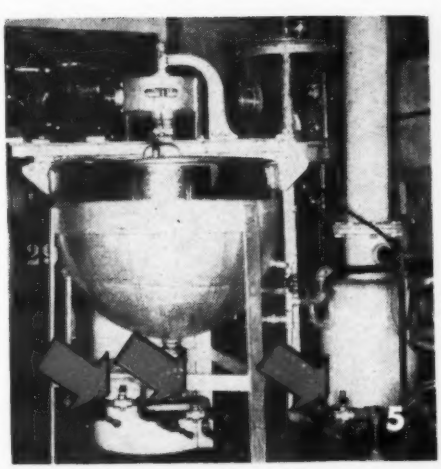
U.S.D.A. photo by Audsley

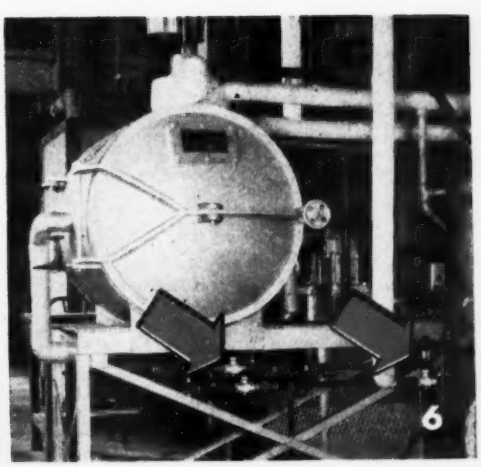




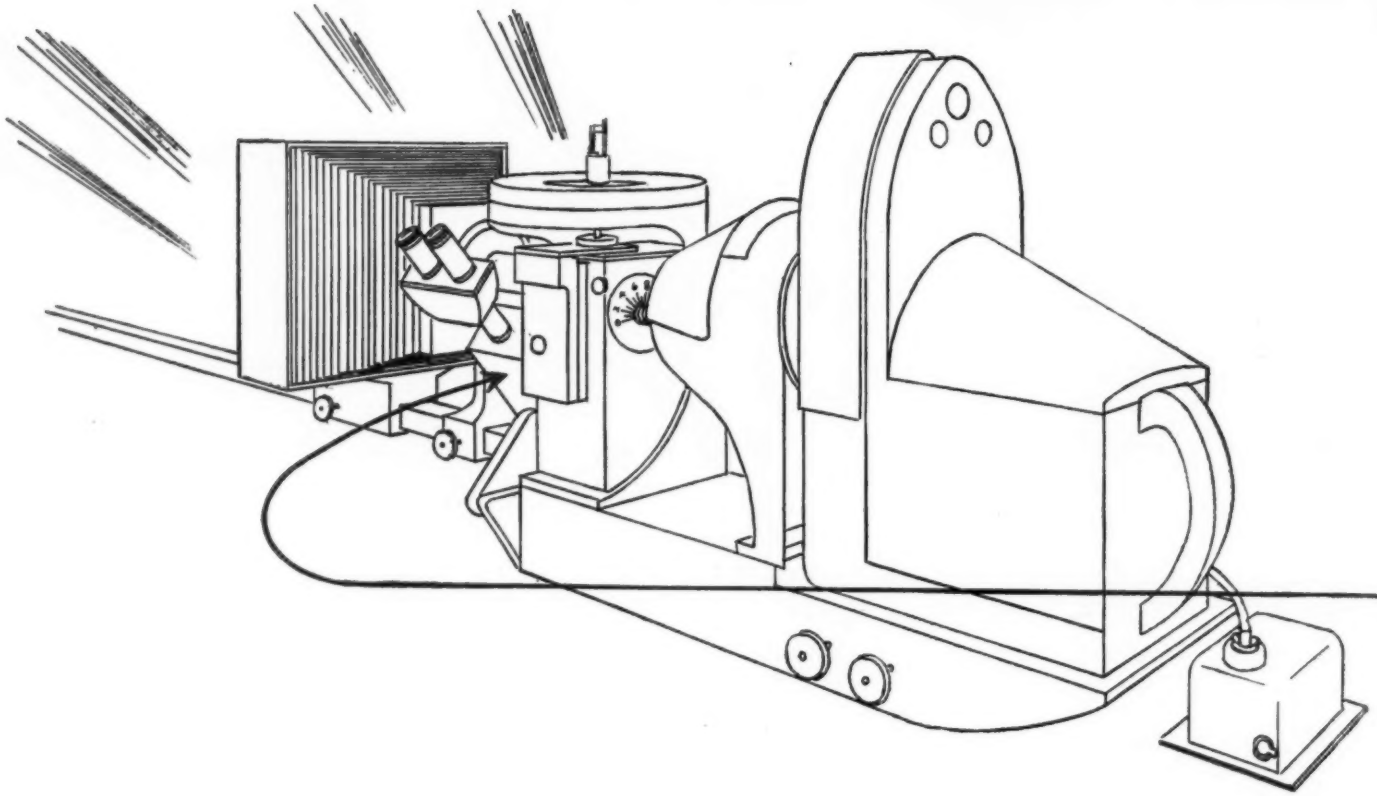


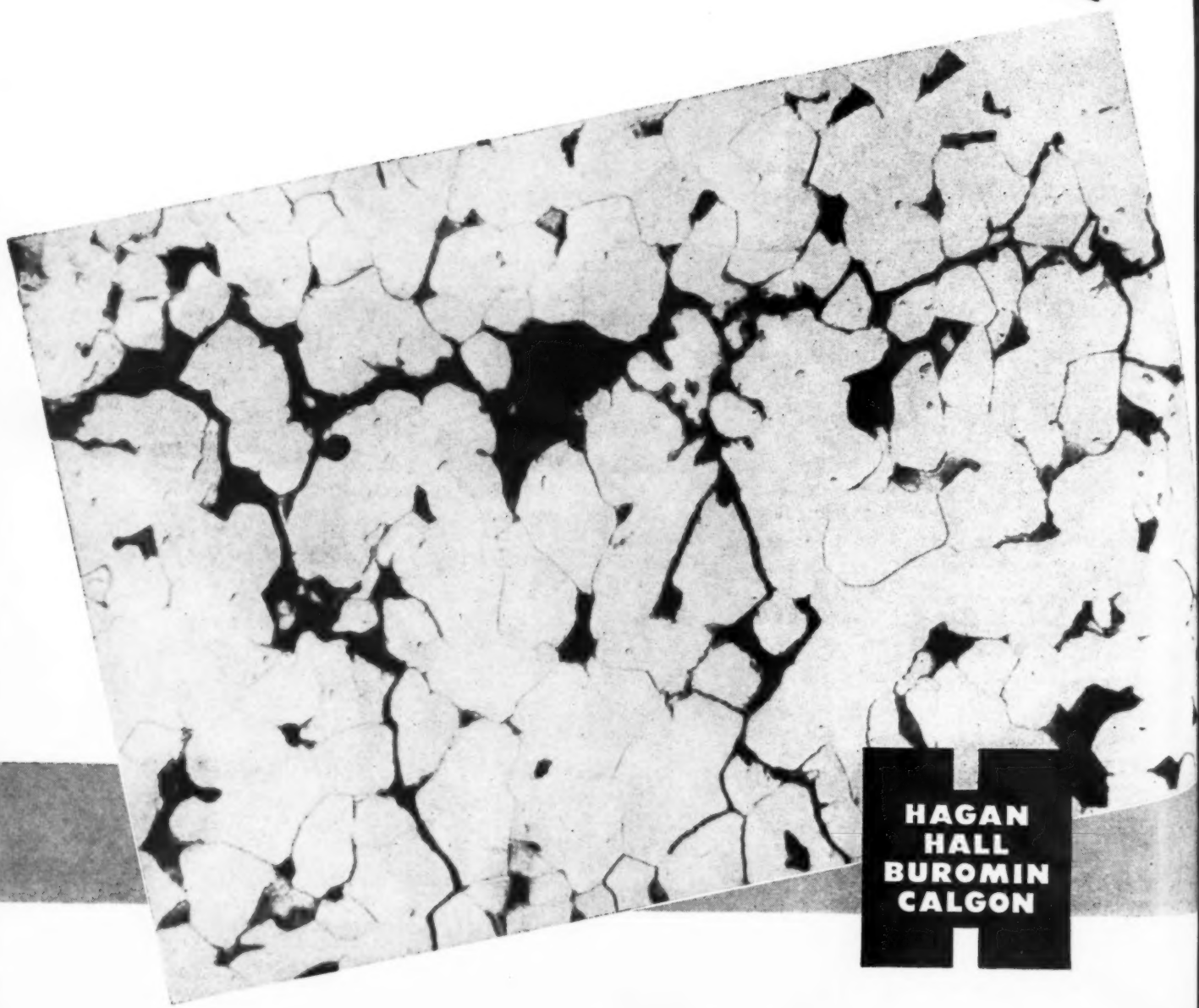
1. Organic Research Unit at the Eastern Regional Research Laboratory.
2. Overhead arrangement of two Yarway Impulse Steam Traps handling condensate from experimental equipment on floor above.
3. Yarway Traps on two steam jacketed stainless steel tanks.
4. Yarway Trap on condensate line from steam jacketed filter press.
5. Three Yarway Traps on agitated steam jacketed kettle.
6. Three Yarway Traps on steam-heated vacuum drum dryer.





IMPULSE STEAM TRAP





HAGAN
HALL
BUROMIN
CALGON

Embrittlement?

—Metallographic examination gave the answer

In a Colorado plant, operating two 250 hp. longitudinal drum boilers at 120 pounds pressure, tubes frequently cracked circumferentially where the tubes were rolled into the tube sheet.

During some periods boiler outages occurred as frequently as once a week, and as many as three tubes had to be replaced each time—a costly nuisance.

A Hall service engineer was called in for consultation and a survey of prevailing water conditions was made. Also a section of a cracked tube was sent to Hall Laboratories for examination.

Not wishing to jump to conclusions Hall engineers proceeded with metallographic examination. If the cracks were due to corrosion fatigue, the fracture would be trans-crystalline in nature. The photomicrographs, however, showed a number of fine cracks which were definitely intergranular in character—evidence of caustic embrittlement.

Once the cause of the cracking was determined, the remedy was simple. On the basis of results of an embrittlement testing program conducted for several years on operating boilers in more than 300 plants, Hall Laboratories recommended the addition of sodium nitrate to the boiler water. Since the use of this embrittlement inhibitor was started, more than six months ago, there have been *no* tube failures.

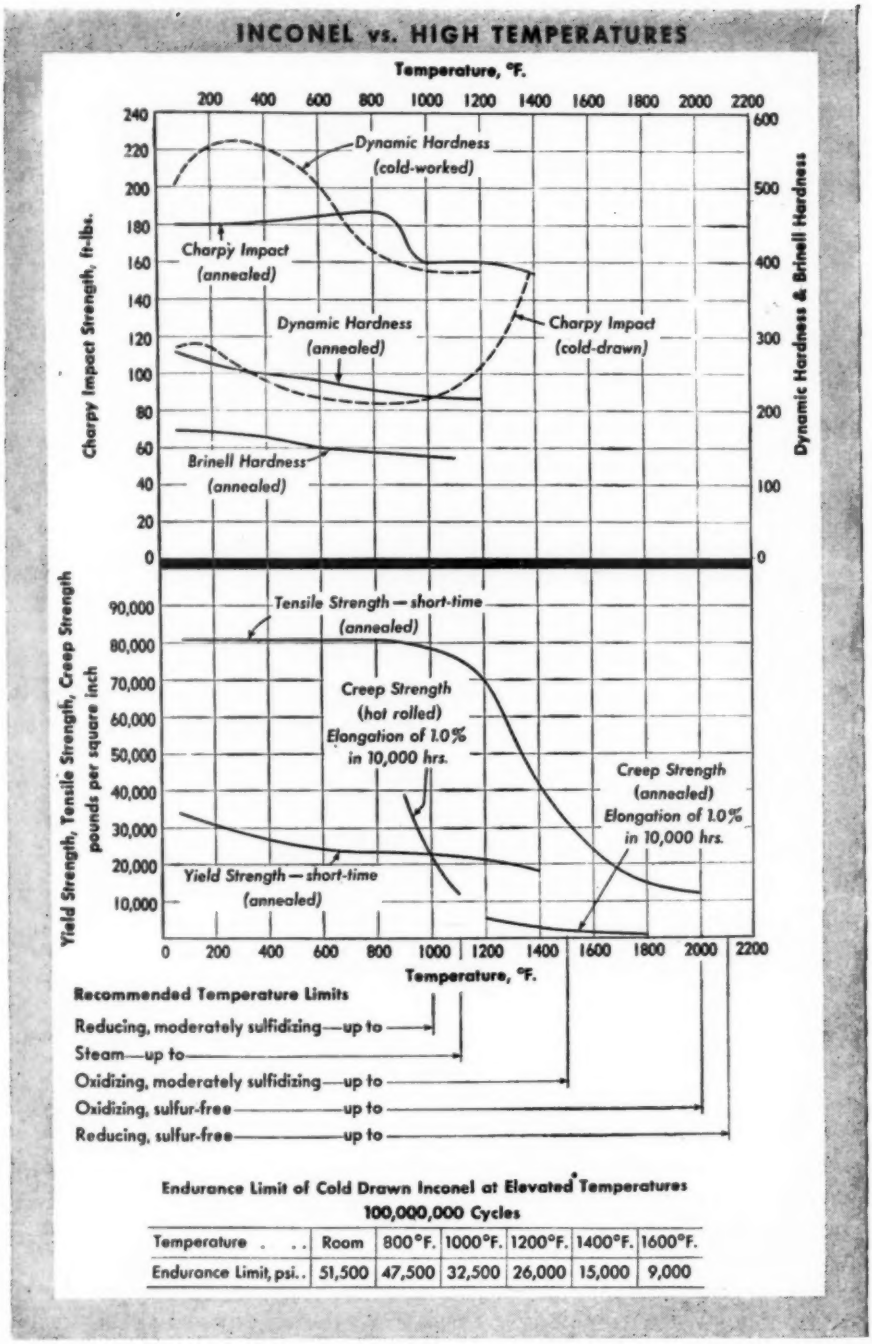
The objective of Hall Laboratories and Hall service engineers is to *prevent* boiler trouble. When trouble *does* occur, the knowledge gained through long experience and constant research enables them to trace the trouble to its source and correct it.

Every plant that generates its own steam can profitably use Hall Service. We will be glad to send you full information.

HALL LABORATORIES, INC., HAGAN BLDG., PITTSBURGH 30, PA.
(A subsidiary of Hagan Corporation)

HALL SYSTEM *of Boiler Water Conditioning*

These Inconel properties can help you solve many HIGH TEMPERATURE problems


INCONEL vs. HIGH TEMPERATURES
Temperature, °F.
200 400 600 800 1000 1200 1400 1600 1800 2000 2200
Dynamic Hardness (cold-worked)
Charpy Impact (annealed)
Dynamic Hardness (annealed)
Charpy Impact (cold-drawn)
Brinell Hardness (annealed)
Charpy Impact Strength, ft-lbs.
Dynamic Hardness & Brinell Hardness
Tensile Strength — short-time (annealed)
Creep Strength (hot rolled) Elongation of 1.0% in 10,000 hrs.
Creep Strength (annealed) Elongation of 1.0% in 10,000 hrs.
Yield Strength — short-time (annealed)
Yield Strength, Tensile Strength, Creep Strength pounds per square inch
Temperature, °F.
Recommended Temperature Limits
Reducing, moderately sulfidizing—up to
Steam—up to
Oxidizing, moderately sulfidizing—up to
Oxidizing, sulfur-free—up to
Reducing, sulfur-free—up to

Endurance Limit of Cold Drawn Inconel at Elevated Temperatures
100,000,000 Cycles

Temperature . .	Room	800°F.	1000°F.	1200°F.	1400°F.	1600°F.
Endurance Limit, psi..	51,500	47,500	32,500	26,000	15,000	9,000

To stand high temperatures, a metal must have:

1. **Good resistance to oxidation**
2. **Good mechanical properties at high temperatures**

Alone, neither one of these properties amounts to much. If cross-sections are rapidly reduced by the scaling away of oxidized layers, high strength is of little value. On the other hand, if the material becomes too soft and weak at operating temperatures to support the designed load, then freedom from scaling goes for naught.

The only way to get the long life you're after, is to specify a metal possessing *both* properties.

In Inconel you have both!

An 80 per cent nickel—14 per cent chromium alloy, Inconel ideally combines the thermal durability of these two elements.

Inconel resists scaling and intercrystalline attack; shows high tensile strength, creep strength, impact strength, endurance limit and hardness at elevated temperatures. The charts above show why Inconel has set so many service records.

Remember Inconel wherever you have to fight Heat! Among power plant uses are packing, springs, special gaskets, refractory bolts, ash screens, thermocouple protection tubes, valve parts, instruments and the like.

For more information on the mechanical properties of metals, write for:
"THE TECHNICAL EDITOR SPEAKS."

NICKEL INCO **ALLOYS**

THE INTERNATIONAL NICKEL COMPANY, INC., *67 WALL STREET, NEW YORK 5, N. Y.*

MONEL* · "K" MONEL* · "R" MONEL* · "KR" MONEL* · "S" MONEL* · INCONEL* · NICKEL · "L" NICKEL* · "Z" NICKEL*
*Reg. U. S. Pat. Off.

Buy Safer, Smaller

CLASS "B" INSULATED DRY-TYPE TRANSFORMERS!

Comparison shows you get easier installation ... safer operation ... and longer transformer life!

FEATURES	Allis-Chalmers	Make "B"	Make "C"	Make "D"	Make "E"	Make "F"	Make "G"
Class "B" Insulation	YES	YES	YES	NO	NO	NO	NO
Light Weight, Compact	YES	YES	YES	NO	NO	NO	NO
Clamp Connectors on Some Sizes	YES	NO	NO	YES	NO	NO	NO
Solidly Enclosed Core & Coils	YES	NO	YES	YES	NO	NO	NO
Liberal, Accessibie Wiring Compartment	YES	YES	YES	YES	NO	NO	YES
Modern, Attractive Appearance	YES	NO	YES	YES	NO	NO	NO

CORE AND COIL assembly shows Class "B" insulation which protects against moisture, eliminates use of combustible materials and fireproof vaults. Note also the rigid terminal board with clamp connectors — a standard feature of the new improved Allis-Chalmers transformers.

You can choose from new BD and BDT units in 14 sizes, ranging from 1½ to 200 kva, single-phase, and 10 to 300 kva, three-phase.

Class "B" insulation in Allis-Chalmers new BD and BDT Dry-Type Transformers reduces overall size *as much as 1/3* over conventional Class "A" insulated types — reduces weight *22 to 38%*.

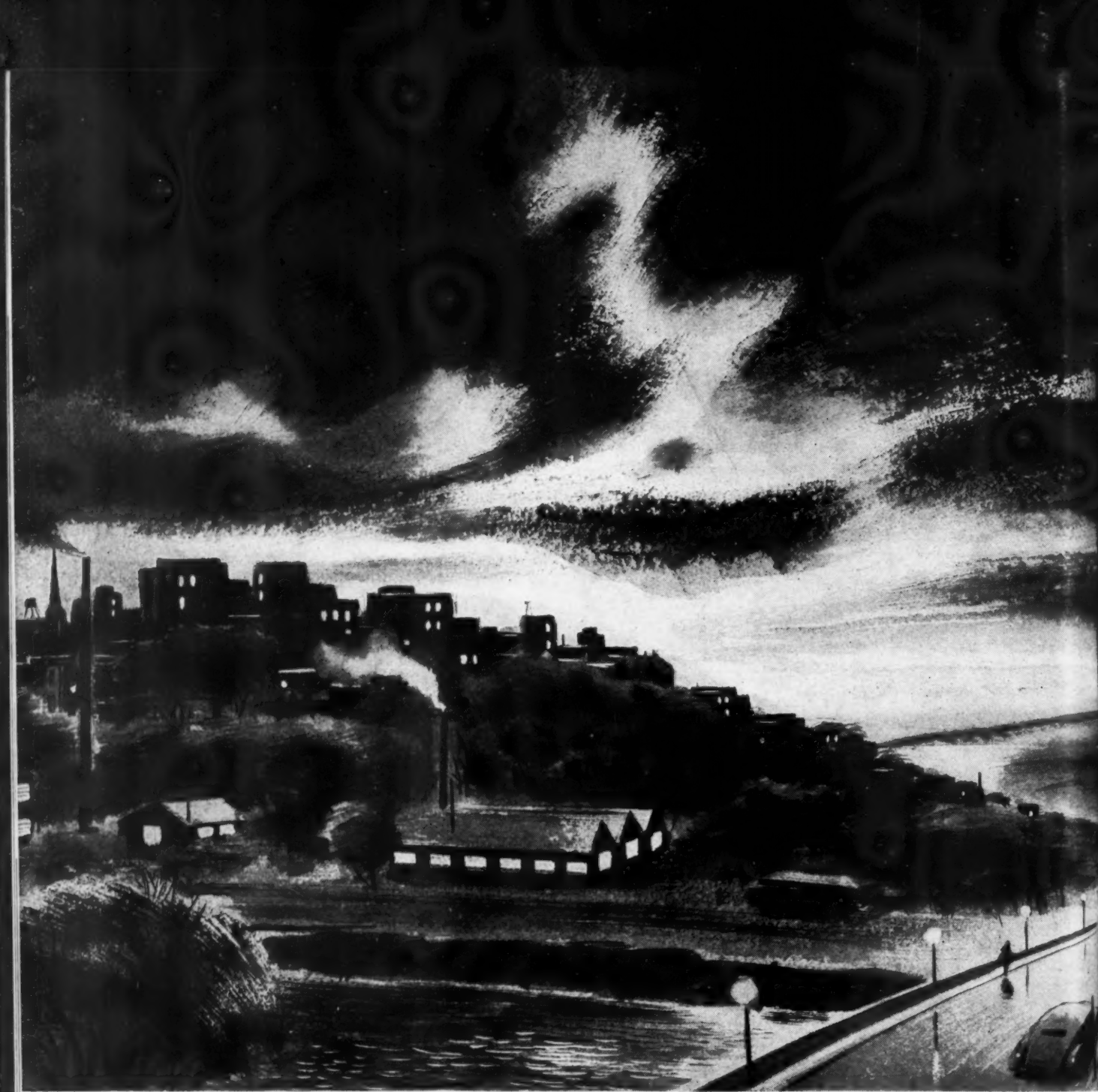
This simplifies installation ... enables you to locate secondary power *almost any place* you want it!

You'll need less mounting materials — will get longer service for no increase in cost over Class "A" insulated types. It adds up to lower overall cost for you!

For complete details get in touch with your nearest Allis-Chalmers dealer or sales office, or send for new bulletin B6382. ALLIS-CHALMERS MFG. CO., MILWAUKEE 1, WISCONSIN.

A2097

ALLIS CHALMERS — **DRY-TYPE TRANSFORMERS**



Light Bringer

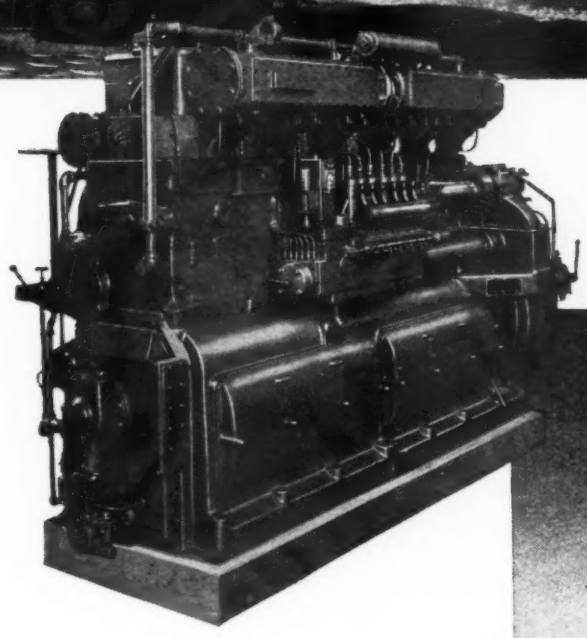
IT IS late afternoon. In the power station, by the river, a generator hums, driven by an ALCO diesel engine. Similar units stand by, waiting.

Overhead a cloud appears, widens, darkens, blots out the sun. Through the sudden gloom lights appear in factories, offices, stores, homes. The power station load shoots upward.

Smoothly, the rising load is picked up as the idle ALCO diesel engines are started. There is no overload, no drop in pressure, no failure of service. Ample power is *immediately* available.

Rugged, compact, high-speed ALCO diesel engines are built for heavy duty; they provide maximum power per pound of engine weight, and per square foot of space occupied.

These are important advantages for practically any power unit application for either stationary or marine service.



American Locomotive

Alco

THE MARK OF MODERN ENGINEERING

WET COAL CAN'T CLOG THIS Æ STOKER

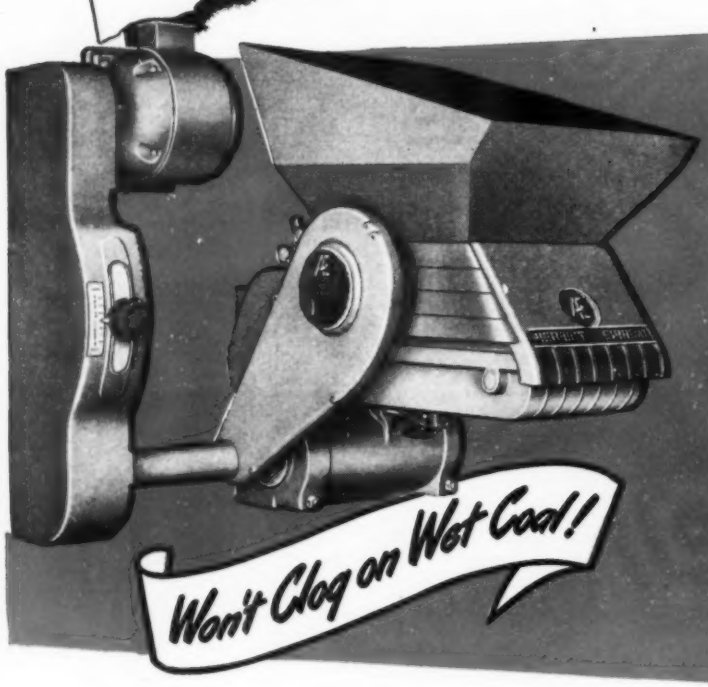
AND THIS is no idle claim. Not *one* complaint of clogging by wet coal has ever been received from our many users.

The Æ Perfect Spread Stoker will feed and burn coal wet or dry, fine or coarse without clogging. It is the only spreader stoker with a travelling conveyor feeder and safety feature that *guarantees* non-clogging *regardless of the size or condition of coal used!*

Every plant has wet coal at some time. End *your* wet coal troubles. Decide today in favor of lower steam costs and cleaner, more efficient boiler room operation with the Æ Perfect Spread Stoker. Write at once for the Æ Perfect Spread Stoker bulletin.

NEW FEATURES UNVEILED AT 17th BIRTHDAY PARTY

Streamlined dress, simplified operation, improved coal distribution, positive non-clog feed—these are the products of growth proudly presented on the Perfect Spread Stoker's 17th anniversary—a hard-earned tribute to long, economy-proved service in 15 types of industries.



Won't Clog on Wet Coal!

Æ

PERFECT SPREAD STOKER

WITH STATIONARY GRATES, DUMPING GRATES OR CONTINUOUS ASH DISCHARGE —UP TO 400,000 LBS. OF STEAM PER HR.

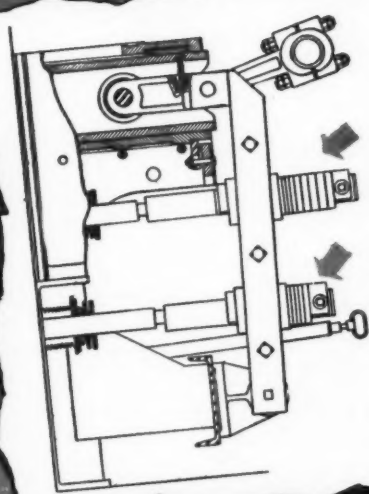
Other Æ Products: Æ-Taylor Stokers; La-Mod Hoists, Marine Deck Auxiliaries, Hele-Shaw Fluid Power

AMERICAN ENGINEERING COMPANY

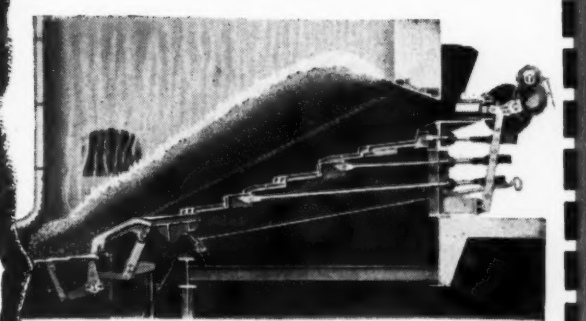
2400 ARAMINGO AVENUE • PHILADELPHIA 25, PA.

What a Whale of a Difference!

. . . BUT THE BASIC PRINCIPLE IS STILL THE SAME



SIMPLIFIED FRONT END DRIVE WITH PRECISION — ADJUSTABLE — INDEPENDENT PUSHER CONTROLS



IMPROVEMENTS Make the Difference in Æ Taylor Stokers, Too!

IF YOU examine today's Æ Taylor Stoker, you'll find embodied in *all* its advanced engineering features a singleness of purpose—dependable, low cost steam generation. A typical example is the secondary pusher control feature of the simplified front end drive. These pushers move the fuel with precision throughout its travel on the grate because they operate independently of the coal rams, with basic stroke settings adjustable within ⅛-inch to prevent overshooting. The few modifications necessary can be readily made in operation.

Engineering improvements such as this have continuously increased the efficiency of the inclined multiple retort underfeed firing principle first established by Æ 40 years ago. Under radically changing conditions it has been economy-proved time and again in hundreds of installations of all sizes.

When comparing *any* fuel firing equipment, remember that the modern Æ Taylor Stoker offers you Æ pioneered *basic* advantages combined with exclusive mechanical *improvements*. Complete details are shown in Catalog R-A. Write for it, or ask our engineers to answer your technical questions.

Other Æ Products: Æ-Perfect Spread Stoker, Lo-Hed Hoists, Marine Deck Auxiliaries, Hele-Shaw Fluid Power.

Æ

TAYLOR STOKER

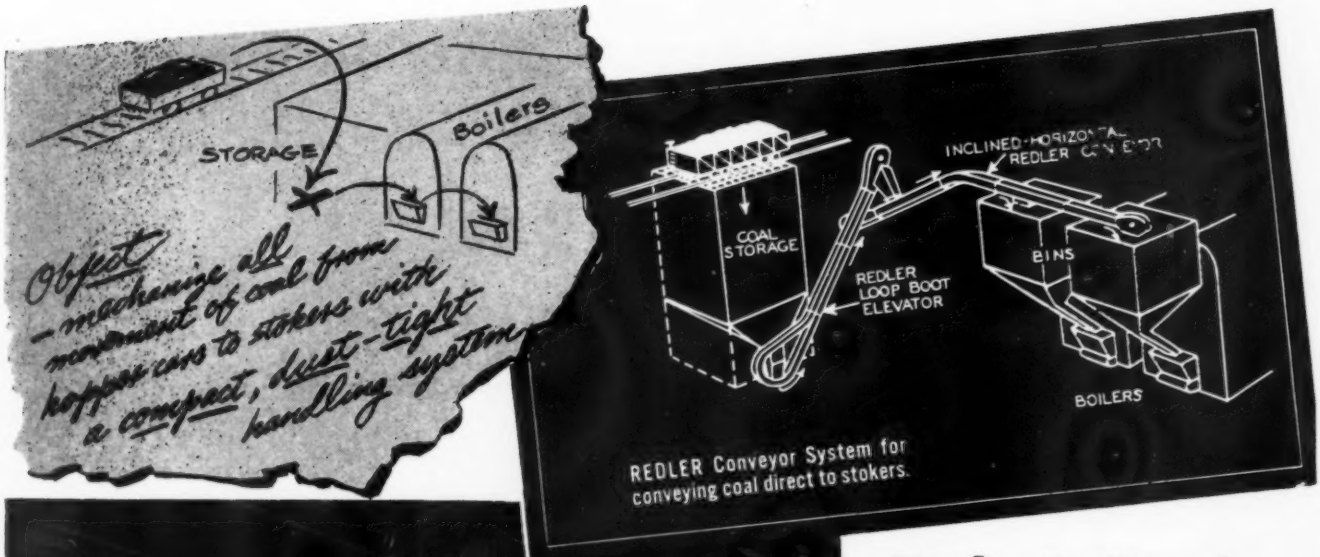
AIR-COOLED & WATER-COOLED

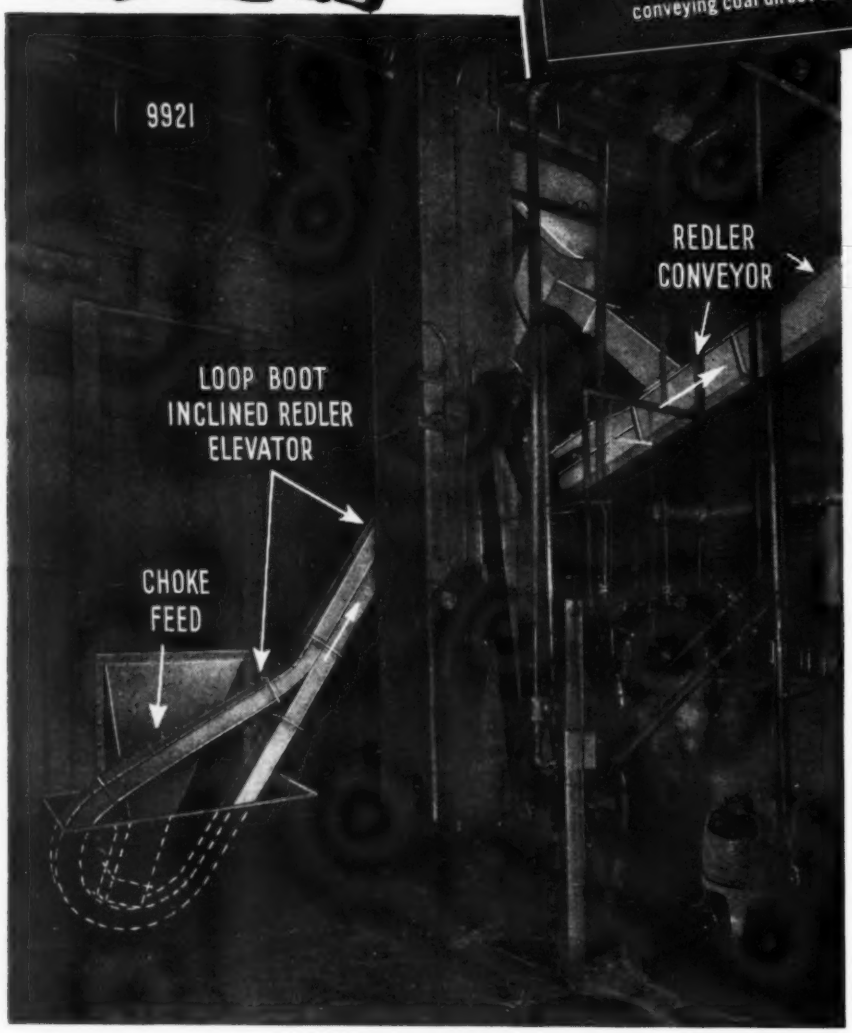
The Only Underfeed Stoker with *all* these Features IN COMBINATION!

1. Continuous Self-Sealing Ash Disposal
2. Movable Ash Discharge Plates
3. Smooth-Flow Hydraulic Drive on Rear End
4. Independent Pusher Controls within ⅛ inch
5. Unique Sure-Feed Coal Agitators
6. Silent-Shift Spur Gear Planetary Power Transmission

AMERICAN ENGINEERING COMPANY

2400 ARAMINGO AVE., PHILADELPHIA 25, PENNSYLVANIA


STORAGE
Boilers
Object
– mechanize all movement of coal from hopper cars to stokers with a compact, dust-tight handling system
COAL STORAGE
REDLER LOOP BOOT ELEVATOR
BINS
BOILERS
REDLER Conveyor System for conveying coal direct to stokers.



Stored coal is reclaimed by an S-A REDLER Loop-Boot Elevator and fed direct to an inclined-horizontal REDLER conveyor which conveys it direct to bins over boiler stokers.

Make It Simple... Feed It Direct with REDLER CONVEYORS

• Achieving easier, lower-cost coal handling doesn't necessarily involve extensive space or changes. For proof, see the S-A system pictured above.

Coal for this power plant is discharged straight from hopper cars into a storage bin under the railroad tracks —is fed directly into the looped boot of an inclined REDLER elevator—and is then transferred to a horizontal REDLER conveyor for distribution to stoker hoppers. This installation was accomplished *without* major alterations ...occupies *very little* space...is *completely enclosed* to prevent coal dust and dirt escaping while coal is in transit.

Whatever *your* handling problem, let S-A engineers help you plan the *right* system to solve it most efficiently and economically.

STEPHEN S-A ADAMSON MFG. CO.

5 RIDGEWAY AVENUE, AURORA, ILLINOIS — LOS ANGELES, CALIF. • BELLEVILLE, ONT

Designers and Manufacturers of All Types of

BULK MATERIAL HANDLING EQUIPMENT

Running to Ruin

...SO THAT YOU WILL GET LONGER LIFE FROM EVERY TEXROPE V-BELT

THIS MACHINE tests TEXROPE Super-7 V-Belts — runs them at varying speed and load until they give out. A trained operator records results: How long did they last? What broke down first: Cords? Cover? Rubber compound? Does destructive heat develop?

Out of tests like this have come stronger cords—tougher, more wear-resistant covers — resilient, cooler-running rubber — vital improvements in design and construction. TEXROPE Super-7 V-Belts are today the BEST in 20 years of V-Belt experience.

A-C FOR COMPLETE V-BELT SERVICE

Call your nearest Allis-Chalmers office or dealer for ALL your V-Belt drive needs — TEXROPE Super-7 V-belts all types, all sizes; TEXSTEEL, TEXDRIVE and "Magic-Grip" Sheaves; VARI-PITCH Sheaves and SPEED CHANGERS. They're all engineered and backed by the originators of the Multiple V-Belt Drive for industry. ALLIS-CHALMERS, MILWAUKEE 1, WIS.

A 2099

PICK YOUR SUPER-7 V-BELT

Heat-Resisting Super-7
Stands temperatures up to 180°. The TEXROPE V-Belt for most drives.

Oil-Resisting Super-7
Neoprene cover protects core against moderately oily or greasy conditions.

Oil-Proof Super-7
Made of Neoprene throughout. Use it when the belt must swim in oil.

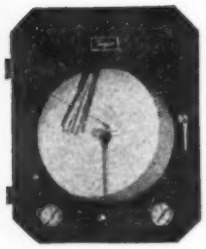
Static-Resisting Super-7
Recommended where explosion hazard exists. Static-conducting element throughout cover won't wear off.

TEXROPE Super-7 V-Belts result from the co-operative research of two great companies—Allis-Chalmers and B. F. Goodrich—and are sold exclusively by A-C.

ALLIS-CHALMERS

One of the Big 3 in Electric Power Equipment — Biggest of All in Range of Industrial Products

TEXROPE V-BELT DRIVES



Here's what we

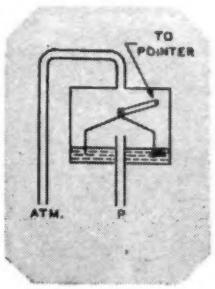
IF YOU have a pressure problem, you can probably find the answer on these two pages. As you well know, pressure must be accurately *measured* before it can be accurately indicated, recorded or controlled. And accurate measurement depends upon proper selection of the measuring element for the operating pressure range, required safety factors, and details of the medium to be measured.

This array of Taylor pressure-measuring elements is the result of our many years of development in serving the process industries. All are standard, proven, high quality Taylor systems. They are available in indicating, recording and controlling instruments, and widely interchangeable. With this complete line to choose from, your Taylor Field Engineer can help you select the exact combination that fits your requirements. Taylor Instrument Companies, Rochester, N. Y., and Toronto, Canada. *Instruments for indicating, recording and controlling temperature, pressure, humidity, flow and liquid level.*

GAGE (and vacuum)

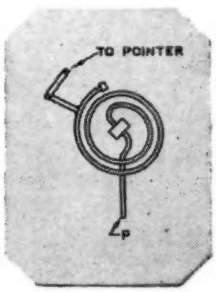
Range limits: 0 to 1" water to 0 to 10,000 psi. The most common type of pressure instrument. Correct measuring element is determined by operating range and conditions of installation. Charts are usually calibrated in pounds per square inch (psi) or inches of water—but usually can be provided in any suitable units of measurement: millimeters of mercury, atmospheres, etc. Accuracy guaranteed to 1% of scale range.

**Asterisk indicates measuring element is for pressure only, not vacuum.*



bell manometer

Cast iron, mercury sealed. Range limits: for pressure or vacuum from 0-1 to 0-10" water, or equivalent units of measurement.

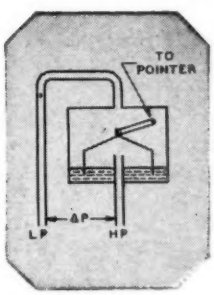


bourdon spring

Standard actuation for pressure. Bronze, steel or alloy steel. Ranges: 0-25 to 0-2000 psi.

DIFFERENTIAL

Range limits. 0-1" water to 25 psi. Widely used to measure pressure drop between two points . . . over a still, for example. Also used to measure rate of flow when an orifice or other suitable differential-pressure producing device is installed in fluid line. Accuracy guaranteed to 1%.

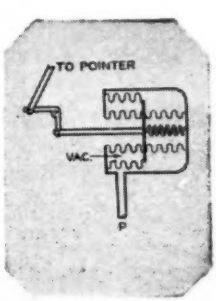


bell manometer

Cast iron, mercury sealed. Ranges: 0-1 to 0-10" water.

ABSOLUTE

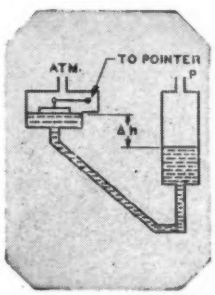
Range limits: 0-5 to 0-25 psi. With this type instrument, pressures are measured by compensated bellows element. (This becomes increasingly desirable at low absolute pressures—because boiling points are related to absolute pressure, not vacuum.) Instruments with absolute pressure actuation are used on low pressure condensers, stills, vacuum pans—in fact wherever absolute temperature correlation is important. These instruments are completely compensated for barometric pressure changes. Accuracy guaranteed to 1% of scale range.



bellows

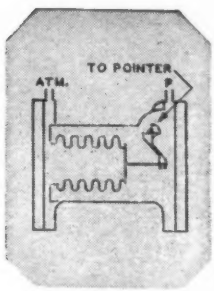
Sealed bellows, no stuffing box. Bellows and housing bronze. Ranges: 0-5 psi absolute (or 0-10" mercury; or 0-250 mm mercury) to 0-25 psi absolute.

do under Pressure



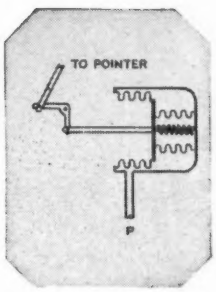
U-tube manometer

Mercury U-tube with float on surface. Cast iron or steel. Range limits: 0-10 to 0-200″ water.



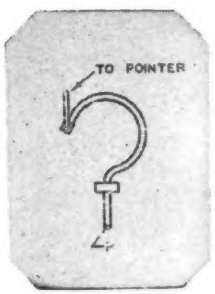
aneroid manometer

Steel body with bellows of bronze or 18-8 alloy. Torque tube, no stuffing box. Ranges: 0-20 to 0-500″ water; 0-20 to 0-100 psi.



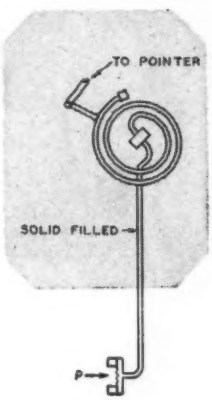
bellows

Sealed bellows, no stuffing box. Bellows and housing bronze. Ranges: 0-3 to 0-25 psi.



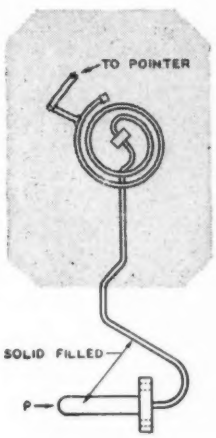
C spring*

Variation of multi-coiled bourdon spring. Entirely steel. Ranges: 0-2001 to 0-10,000 psi.



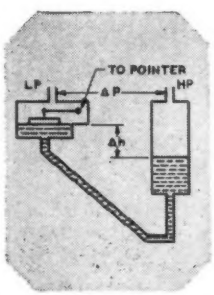
diaphragm*

Self-contained. For measuring sludges, etc. Diaphragm of any material. Maximum length of tubing 50 ft. Ranges: 0-15 to 0-500 psi.



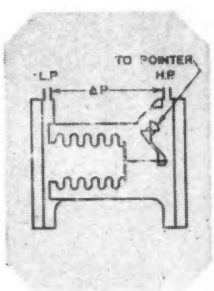
volumetric pressure for liquids*

Steel (silver plated for sanitary services). Compression of bulb actuates spring. Temperature compensation permits tubing up to 35 ft. Range: 0-5000 psi.



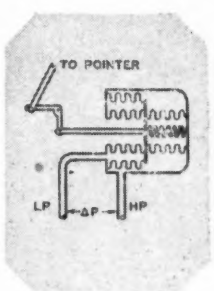
U-tube manometer

Mercury U-tube with float on surface. Cast iron or steel. Ranges: 0-10 to 0-200″ water.



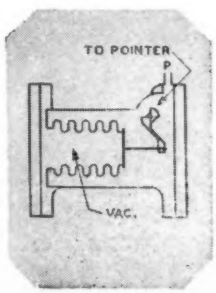
aneroid manometer

Steel body with bellows of bronze or 18-8 alloy. Torque tube, no stuffing box. Ranges: 0-20 to 0-200″ water (0-500″ on order).



bellows

Sealed bellows, no stuffing box. Bellows and housing bronze. Ranges: 0-5 to 0-25 psi.



aneroid manometer

Steel body with bellows of bronze; torque tube of stainless steel; no stuffing box. Ranges: 0 to 20 to 0-500″ water absolute, or equivalent units of measurement.

Taylor Instruments

MEAN

ACCURACY FIRST

IN HOME AND INDUSTRY

Every Month for 15 Years...

THE BETZ INDICATOR

IT has always been the policy of the Betz organization to publish and distribute informative literature pertaining to the many-sided subject of industrial water conditioning. As new developments occur, or as established practices are improved upon, we publicize the information. To date, we have offered more than 150 technical papers, bulletins and reference handbooks—all dealing with industrial water conditioning or some closely allied subject.

Typical of these many publications is the *Betz Indicator*, which has been issued monthly—without interruption—for fifteen years. Each issue features one or more topics concerned with water conditioning or water analyses, in addition to other articles of universal interest to the engineer. The illustration for the cover page shows water in some form and is chosen from a selected group of salon photographs. From a modest beginning, circulation has now reached 15,000 copies—with mailings to every state in the Union, every province in Canada, and to many foreign countries.

Yes, month after month after month the *Betz Indicator* is mailed to thousands of chemists, engineers, plant superintendents and others interested in the vitally important subject of water conditioning. If you, too, would like to receive it without cost or obligation, all you need do is make the request on your company letterhead.

W. H. & L. D. BETZ • 4556 Worth Street • Philadelphia 24, Penna.

BETZ

BOILER WATER CONDITIONING • COOLING WATER CONDITIONING • INDUSTRIAL WASTE TREATMENT

VALVES designed for the modern Power Plant

Years ago, when American Industry was still in its infancy, The Wm. Powell Company adopted a definite, farsighted policy . . . to concentrate on making valves only—valves of *every* design, for *every* service in *every* branch of industry.

That is why, today, Powell can supply valves to meet every known flow control requirement in your plant. And, if you have any flow control problems, Powell Engineers will gladly help you solve them.

When writing for catalogs, kindly specify whether you are chiefly interested in Bronze, Iron or Steel Valves.

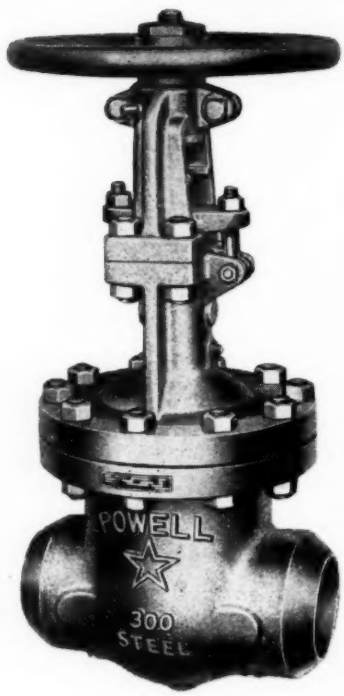


Fig. 3003 W. E.

Fig. 3003 W. E.—Class 300-pound Cast Steel Gate Valve with welding ends, outside screw rising stem and bolted flanged yoke.

Fig. 25003 W. E. (opposite page) Class 2500-pound Cast Steel Welding End O. S. & Y. Gate Valve.

Fig. 375

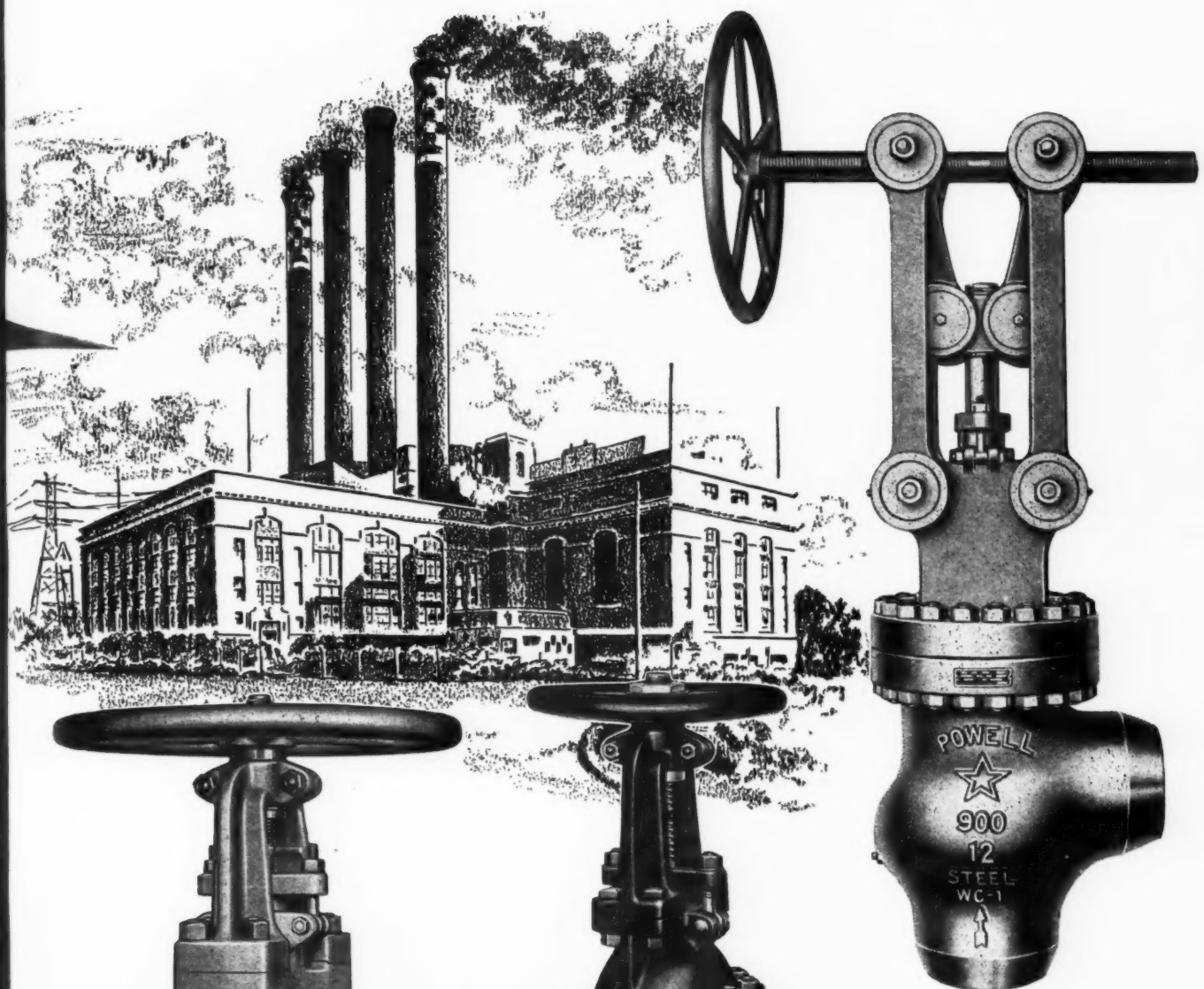
Fig. 375—200-pound Bronze Gate Valve with screwed ends, inside screw rising stem, union bonnet and renewable, wear-resisting "Powellium" nickel-bronze disc.

Fig. 6061 W. E. (opposite page) Class 600-pound Cast Steel Swing Check Valve, with welding ends and bolted cap. Disc has ample lift to permit full, straightway, unobstructed flow through the valve when wide open.

The Wm. Powell Company
Cincinnati 22, Ohio

DISTRIBUTORS AND STOCKS IN ALL PRINCIPAL CITIES

POWELL



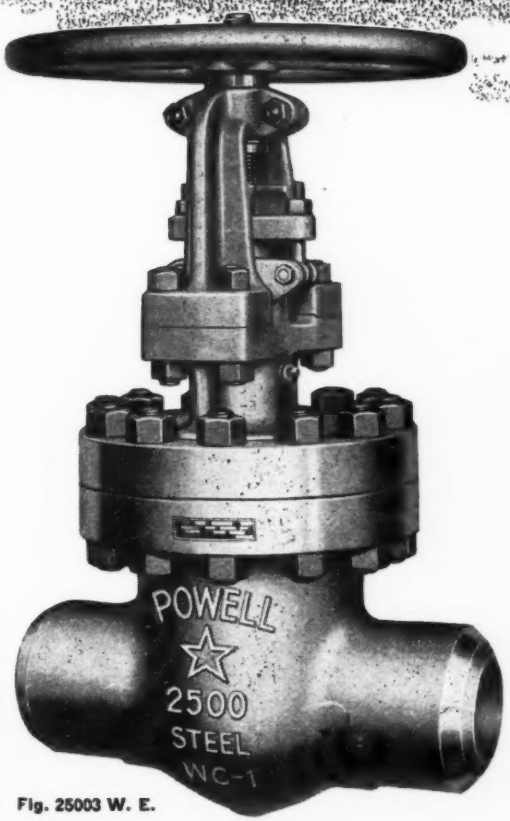


Fig. 25003 W. E.

Fig. 1793

Fig. 1793—125-pound Iron Body Bronze Mounted Gate Valve. Has flanged ends, outside screw rising stem, bolted flanged yoke, bronze seat rings and taper wedge solid disc. Also available in All Iron.

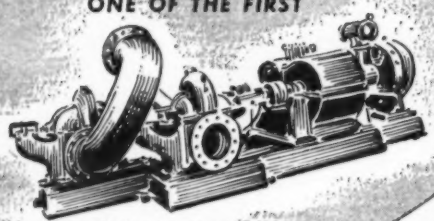
(Above) Class 900-pound, 12" Welding End Cast Steel Non-return Angle Valve. Toggle operated.

Fig. 6061 W. E.

VALVES

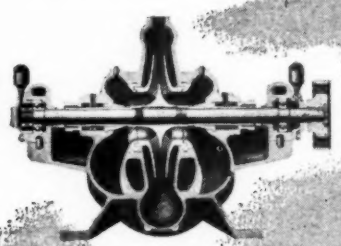
45 Years of PUMP IMPROVEMENT

ONE OF THE FIRST

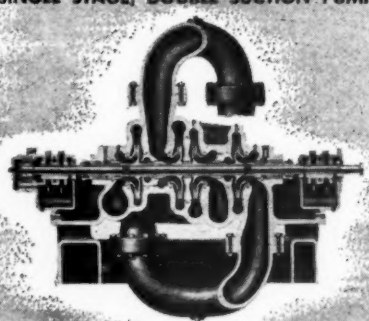


Built by De Laval in 1902

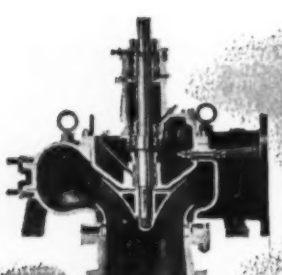
Modern De Laval centrifugal pumps represent the culmination of more than 45 years of continual improvement and perfection. This long period of concentration upon the problems of centrifugal pump design and application places at the user's command a complete line of modern, high quality pumps and a vast store of knowledge concerning pump application problems.



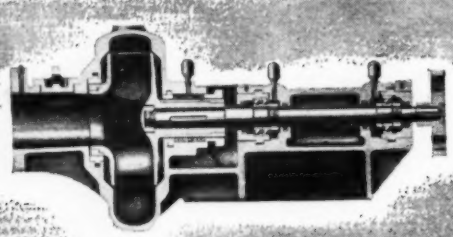
SINGLE STAGE, DOUBLE SUCTION PUMP



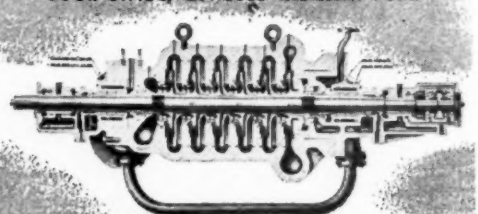
FOUR STAGE, OPPOSED IMPELLER PUMP



MIXED FLOW PUMP



CLOGLESS PUMP



HIGH PRESSURE, MULTI-STAGE PUMP

GP-1

TURBINES • HELICAL GEARS • WORM GEAR SPEED REDUCERS • CENTRIFUGAL PUMPS • CENTRIFUGAL BLOWERS AND COMPRESSORS • IMO OIL PUMPS

DE LAVAL

STEAM TURBINE COMPANY
TRENTON 2, NEW JERSEY

SALES OFFICES: ATLANTA • BOSTON • CHARLOTTE • CHICAGO • CLEVELAND • DENVER • DETROIT • DULUTH • EDMONTON • GREAT FALLS • HAVANA • HELENA • HOUSTON • KANSAS CITY • LOS ANGELES • MONTREAL
NEW ORLEANS • NEW YORK • PHILADELPHIA • PITTSBURGH • ROCHESTER • ST. PAUL • SALT LAKE CITY • SAN FRANCISCO • SEATTLE • TORONTO • TULSA • VANCOUVER • WASHINGTON, D.C. • WINNIPEG

POWER

A McGRAW-HILL PUBLICATION

N O WYNKOOP, *Publisher* P W SWAIN, *Editor*

L N ROWLEY, *Managing Editor*

Associate Editors:

F A ANNETT E W FELLER B G A SKROTZKI

Assistant Editors: J L KING J C McCABE C F SANDERS

Art Editor: C F MARSCHALEK

Business Manager: B E SAWYER

Washington: D D Hogate *Atlanta:* Earle Mauldin

WORLD NEWS OFFICES: *London, Paris, Berlin, Moscow, Prague, Shanghai, Bombay, Mexico City*

SEPTEMBER 1946 VOLUME 90, NUMBER 9

A CROSS-INDEX OF SUBJECTS FOR THE MONTH

PLANT OPERATING METHODS, MAINTENANCE AND SAFETY
STEAM GENERATION, FUELS, FIRING AND COMBUSTION
TURBINES, ENGINES, AUXILIARIES; HYDRO POWER
DIESELS, GAS ENGINES AND ACCESSORIES
AIR CONDITIONING AND REFRIGERATION
ELECTRICAL EQUIPMENT, ELEVATORS
PIPING, VALVES AND SPECIALTIES
TRANSMISSION, LUBRICATION
STEAM SERVICES, HEATING
INSTRUMENTS, CONTROLS
PUMPS, COMPRESSORS

FEATURE ARTICLES

Marion high-pressure Unit No. 10 completes five years' service.... 66

Standardized unit substations help industry solve power problems.. 71

Chemical cleaning takes the bull work out of scale removal: I..... 74

Careful selection and testing of safety valves is vital..... 79

Underpinning a 175-ft operating smokestack..... 82

Safety pointers in the boilerhouse..... 84

Switzerland plans power expansion..... 87

Power at Bikini: P W Swain's report on Operation Crossroads..... 88

What will Europe's future power plants be like?..... 92

Power personalities: George C W Golem..... 97

China plans world's largest hydroelectric power project..... 100

New locomotive power plant and largest gas turbine under test... 104

Large diesels at Panama Canal unique for automatic starting..... 105

THE OPERATING ENGINEER

Adequate routine maintenance keeps hydro generators on the job 109

Practical aids..... 112

Reader's problems..... 116

Pump Q & A..... 120

Refrigeration notebook..... 126

Math tips..... 128

How to—..... 130

OTHER DEPARTMENTS

What's new in plant equipment..... 132

Data sheet..... 140

George Edwards..... 142

Engineer's bookshelf..... 144

Power news..... 146

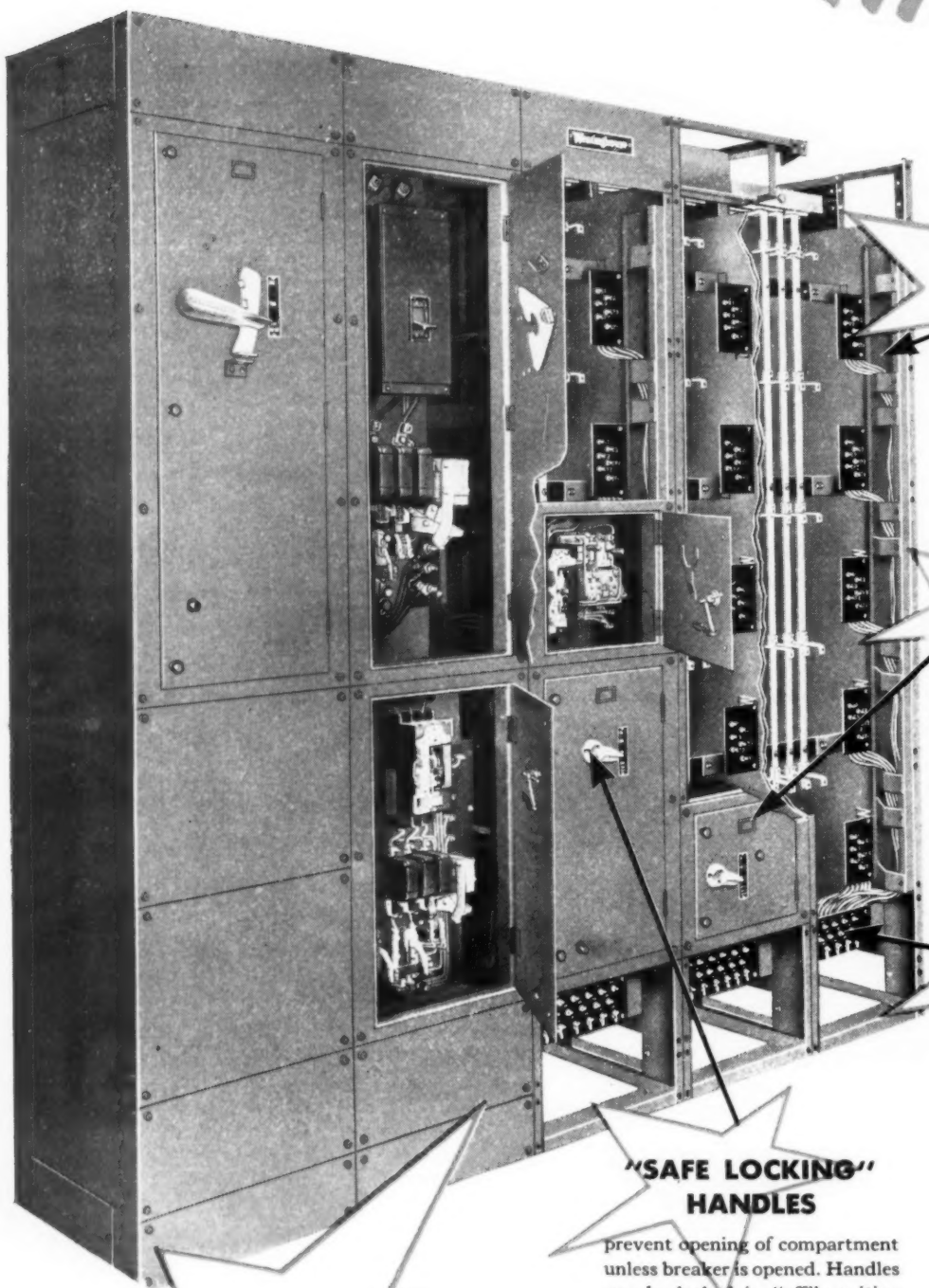
Cover photo, Joint Army-Navy Task Force One

VOLUME 90, NUMBER 9 • ABC • ABP •

COPYRIGHT 1946 by McGRAW-HILL PUBLISHING CO., INC. • ALL RIGHTS RESERVED

James H McGraw, Founder and Honorary Chairman; James H McGraw, Jr, President; Curtis W McGraw, Senior Vice-President and Treasurer; Joseph A Gerardi, Secretary; Nelson Bond, Director of Advertising; Eugene Duffield, Editorial Assistant to the President; J E Blackburn, Jr, Director of Circulation • DISTRICT MANAGERS: New York, W W Quarles; Philadelphia, C R Long; Cleveland, F B Godley; Chicago, C Boughton; Boston, C L Morton; St Louis, G G Sears • PUBLICATION OFFICE: 99-129 Broadway, Albany 1, N. Y. • EDITORIAL AND EXECUTIVE OFFICE: 330 W 42nd St, New York 18, N. Y. • Cable Address: "McGraw-hill New York" • DISTRICT OFFICES: 520 S Michigan Ave, Chicago 11; 68 Post St, San Francisco 4; National Press Bldg, Washington 4; 16 S Broad St, Philadelphia 2; 739-9 Oliver Bldg, Pittsburgh 22; 1510 Hanna Bldg, Cleveland 15; 2980 Penobscot Bldg, Detroit 26; Continental Bldg, St Louis 8; 1427 Statler Bldg, Boston 16; 1011 Rhodes-Haverty Bldg, Atlanta 3; Pacific Finance Bldg, Los Angeles 14; Aldwych House, Aldwych, London WC2 • POWER articles are indexed in both the Industrial Arts and the Engineering Index • POWER issues its own Index annually; copies are available on request to the editorial office, 330 W 42nd St, New York 18.

Easier to install



ACCESSIBLE VERTICAL WIRING TROUGH

in each unit facilitates rearrangement of individual units and simplifies wiring, should master terminal boards not be desired.

STARTER UNITS EASILY REMOVED

from front of structure for relocation or maintenance—provides new operating flexibility.

MASTER TERMINAL BOARD

conveniently located at bottom (or top) of a control center, simplifies connection of outgoing leads. Individual terminal boards make wiring easy to identify, simple to change—connections between starters and master terminal boards made at factory.

"SAFE LOCKING" HANDLES

prevent opening of compartment unless breaker is opened. Handles can be locked in "off" position with from one to three padlocks.

FRONT OR BACK-TO-BACK MOUNTING

. . . twice the number of units can be installed without increasing depth of structure when back-to-back mounting is employed.

FOR ANY CONTROL CALL WESTINGHOUSE

WESTINGHOUSE

easier to maintain...

Application and operating flexibility of Westinghouse Control Centers saves man-hours in installation . . . and maintenance . . . saves space with diversity of mountings.

A big reason why Westinghouse Control Centers are easier to install and maintain is simplicity of design. It simplifies control center problems from planning, ordering . . . down to the last item of maintenance. Regardless of the diversity of ratings required in one structure, a Westinghouse Control Center (built from standardized units) is available. There are three basic reasons for this flexibility:

1. *Standardized dimensions* of the main structure and of individual units. Size 1, 2, 3 and 4 linestarters are mounted in the same sheet steel structure—only section heights vary.
2. *Standardized terminal board system* simplifies wiring because all internal connections are made at factory—all outgoing connections are conveniently located on master terminal board at top or bottom of starter.
3. *Individual starter units* or sections can be rearranged quickly. Units can be installed anywhere in the structure, in any combination.

Because of this complete standardization . . . of every part . . . Westinghouse Control Centers result in much lower over-all cost than made-to-order multimotor control panels. These are only a few advantages of standardized prefabricated Westinghouse Control Centers. All units are standard Westinghouse control items . . . offering the benefit of the half century of Westinghouse control experience. For information, write your Westinghouse office. Ask for Booklet B-3026. Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pa. J-60599

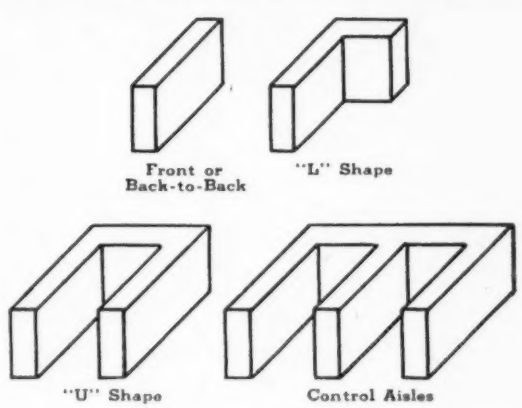
ALL INDIVIDUAL UNITS EASILY REMOVED

It's easy to remove an individual unit—a self-contained combination linestarter (circuit breaker and magnetic across-the-line starter)—just remove line and load leads and loosen four corner screws on trim. Entire unit then slides out for inspection or replacement. Each unit is completely baffled.

Only Westinghouse Control Centers Offer All These Advantages:

- Full installation and operating flexibility—all units 20 inches wide.
- Simplified maintenance, because of centralized, easily accessible controls.
- Smart, modern appearance.
- Standardized structures, permitting easy addition of control units.
- Full mounting flexibility. Starters can be mounted front only, or back-to-back.
- Complete operating safety assured by "safe locking" handles.

TYPICAL ARRANGEMENTS POSSIBLE WITH WESTINGHOUSE CONTROL CENTERS



Westinghouse CONTROL CENTERS

Here are 150 good reasons for using BYERS WROUGHT IRON

Every foot of height in a stack multiplies the cost and difficulty of maintenance and repair, and provides an added reason for using a durable material. In the 150-foot stack recently erected at the Stanley Works, Niles, Ohio, these reasons pyramided up to an impressive total. With the aim of getting maximum life with minimum expense, wrought iron was specified. The Austin Company were the engineers for the new boiler and stack installation. The stack, 4½-feet in diameter, was fabricated by Youngstown Steel Tank Company.

The corrosion that threatens the life of every stack is manufactured right in the firebox. The carbon compounds formed during combustion, when absorbed by condensed moisture, form weak acids that are highly destructive to vulnerable materials. If any sulphur is present in the fuel, the attack is supplemented by sulphur acids. Often conditions may be aggravated by changes in fuels, by the variation of load on the boilers, by intermittent operation, or by the use of steam-jet boosters, so that good design calls for an extra safety factor as a hedge against the future.

A large number of cost-conscious engineers regularly use wrought iron for all applications where an unlined metal stack can be properly installed, on the basis of its record for longer service. The reason for this service is found in its unique structure. Tiny fibers of glass-like silicate slag, 200,000 or more to the square inch of section, are threaded through the body of high-purity iron. These fibers act like baffles, to halt and diffuse corrosive attack, and so discourage pitting. They also anchor the initial protective scale which shields the underlying metal.

Our bulletin, "Wrought Iron for Flue Gas Conductors and Coal Handling Equipment" will give you some interesting information on controlling maintenance in your new stacks. Ask for a copy.

A. M. Byers Co., Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Atlanta, Chicago, St. Louis, Houston, Seattle, San Francisco.

SCRAP NEEDED. *You can speed the production of materials you need by speeding your scrap through usual channels back to the metal producer.*

Corrosion costs you more than Wrought Iron

BYERS
GENUINE WROUGHT IRON
TUBULAR AND HOT ROLLED PRODUCTS
ELECTRIC FURNACE ALLOY STEELS · OPEN HEARTH ALLOY STEELS
CARBON STEEL TUBULAR PRODUCTS

POWER

PHILIP W SWAIN, EDITOR • SEPTEMBER 1946 • ESTABLISHED IN 1882

POWER AT BIKINI

PERHAPS NO SINGLE EVENT has enjoyed as complete news coverage as the atom-bomb tests at Bikini. And rightly so, because these experiments are of transcendent importance to all of us, as human beings in an atomic age, as citizens of a country temporarily custodian of a weapon of devastating power, and as engineers on the threshold of what may be a new era in energy conversion.

To Bikini went observers of all descriptions, from the top scientific minds of the nation to the hangers-on, who somehow always manage to climb aboard. Reports sent back reflect these personal differences; the detailed and sober findings of the scientists, many of which are still confidential; the factual stories of experienced newspaper men and radio commentators; and the feeble blasts of the "lunatic fringe," some merely trivial, some misleading and potentially dangerous.

It could be foreseen that this would be so, and it might have been assumed that by careful selection from the various statements a reasonably accurate picture could be pieced together. To us it was clear that this was not good enough. We believe that atomic fission, with its untold possibilities in war and peace, is the most important single development of our times. Its recording and interpretation thus becomes a paramount necessity, a responsibility of McGraw-Hill to all industry and of POWER to the power engineer. For such a task, nothing but on-the-spot observation will do.

For these reasons, Phil Swain, associated with the reporting of atomic fission since 1940, when he wrote the first statement of its principles to appear in an industrial publication, was assigned to journey to the South Pacific for Operation Crossroads, representing POWER and covering the engineering aspects for the company's other publications. Major author of the pioneering treatises on atomic energy published in all McGraw-Hill magazines (POWER, Sept 1945 and Aug 1946) and long an authority on existing methods of energy conversion, he brought to this assignment the technical background needed to evaluate these experiments in terms familiar to power engineers and industrial men everywhere.

On page 88 of this issue we bring you his personal summary of Operation Crossroads, based on his own investigations and on the data available at the conclusion of the tests. Dealing with the same set of facts, his report must, of necessity, cover some ground already familiar to readers of newspapers. But Swain approaches these facts from the engineer's viewpoint and hence his report tells the power man what he wants to know and tells it in his own language. If any POWER reader needs further information on some specific point Phil will be happy to try to furnish it.

Most important of all, Swain brings back the direct, personal knowledge for which there is no substitute, knowledge that will be reflected in POWER's future reporting of atomic-energy developments, which will be as complete and authoritative as the combined resources of the POWER staff and the McGraw-Hill organization can make it.

Marion High-Pressure Unit No. 10 Completes Five Years of Service

High-pressure unit at Marion Generating Station of Public Service Electric and Gas Co consists of two modern turbine-generators that operate either as a cross-compound condensing unit, or as separate topping and low-pressure turbines

By R A BAKER
Assistant Engineer
Electric Engineering Dept
Public Service Electric and Gas Co

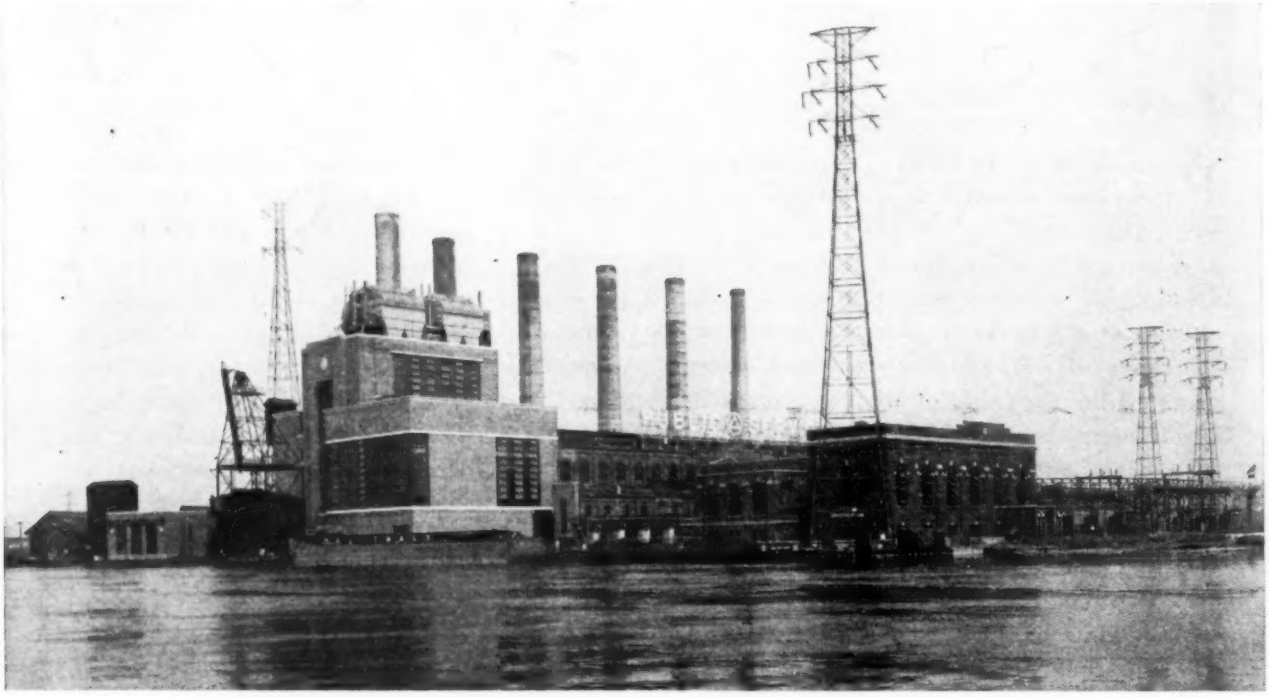


Fig. 1—Marion Generating Station of the Public Service Electric and Gas Co located in Jersey City, New Jersey

▶ WITH THE INSTALLATION of one 3000-kw and two 5000-kw turbine-generators and 15 boilers back in 1903, Marion Generating Station, Jersey City, N. J., marked the beginning of its service. Through a series of expansions and replacements the station finally had a rated capacity of 94,950 kw in 1924, which included 50 boilers supplying 200-psig steam. During the 1930s twenty boilers had their stokers removed and were equipped for oil firing. This improved their quick-loading ability and efficiency, and was good for a total of 70,000-kw capacity.

1940 Addition. When it was decided to install additional capacity, superposition appeared the most advantageous. The most recent 200-psig turbine-generators were in excellent condition while the original 35-year-old boilers were not considered suitable for conversion to efficient operation.

Accordingly a 50,000-kw superposed turbine-generator was installed to take steam at 1250 psig, 950 F, and exhaust to three existing horizontal condensing turbines. The latter were modified slightly to fit them for higher inlet-steam temperatures and lower steam pressures as it was planned to operate the group with variable crossover pressure. This would take advantage of greater expansion in the new turbine. Largest of the three old machines was rerated to 26,600 kw by (1) installing new nozzles and admission valves (2) redesigning some of the blading and (3) adding an autotransformer to the generator, which permitted raising generator voltage from 13,800 to 15,000. Simultaneously this turbine was connected for bleeding at two points. Thus a heat balance was completed that comprised two bleeder points on the new high-pressure turbine and one in the exhaust of this machine, making a total of five stages of feedwater heating.

Turbines. The new high-pressure turbine, built by General Electric Co, is a 14-stage 3600-rpm double-casing impulse machine designed so the outer-shell pressure is that of the 8th stage, about 400 psig. This design materially reduces temperature stress in the shell flanges. Controlling the steam flow are six valves, arranged in two groups of

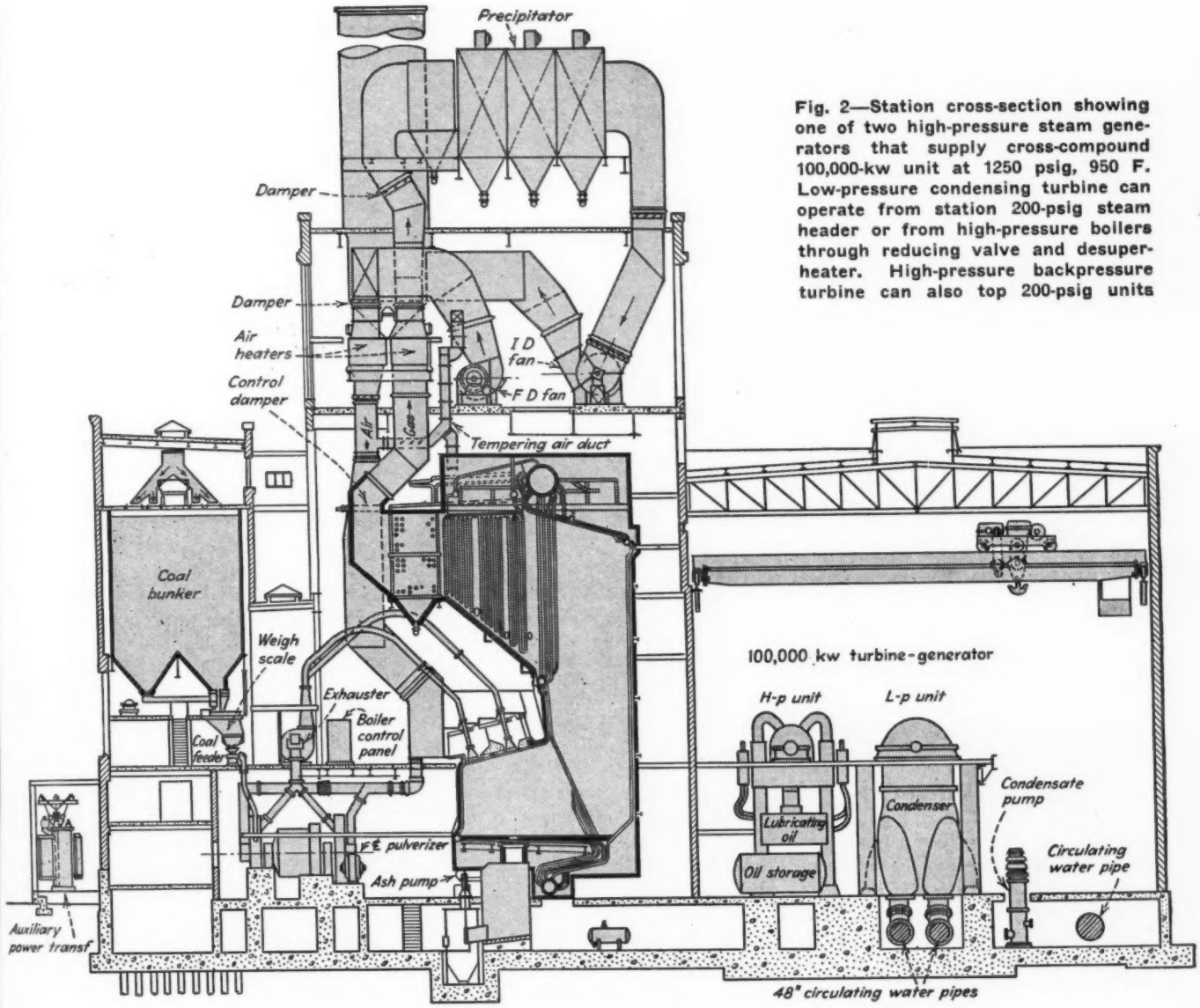


Fig. 2—Station cross-section showing one of two high-pressure steam generators that supply cross-compound 100,000-kw unit at 1250 psig, 950 F. Low-pressure condensing turbine can operate from station 200-psig steam header or from high-pressure boilers through reducing valve and desuperheater. High-pressure backpressure turbine can also top 200-psig units

three each and located on opposite sides of the turbine. The first four open in sequence admitting steam to the first-stage nozzles, while the fifth and sixth valves open simultaneously and connect to the third-stage nozzles.

Provision for future capacity expansion was made by making this turbine an exact duplicate of the high-pressure element of the 100,000-kw cross-compound unit then being installed at Burlington Station. (See POWER, July 1941, pp 56-63). While the Marion installation covered a superposition turbine only, all design elements provided for future cross-compound operation with a new 50,000-kw low-pressure condensing turbine.

This proved a fortunate choice since the rapid system-load increase made it necessary to start work on the low-pressure addition before the original project was placed in service. The low-pressure turbine, also built by General Electric Co, is made up of two double-flow 3600-rpm turbines connected in tandem. When operating cross-compound the inlet pressure varies from 30 to about 120 psi with the load. This turbine can also be operated from the 200-psig header through a separate control valve, supplied either from the 1250-psig boilers through a reducing and desuperheating valve or from the old 200-psig boilers.

Generators. Both new turbines drive identical 50,000-kw 80-percent-power-factor 3600-rpm hydrogen-cooled generators. Each generator drives a main and pilot exciter through a 2 to 1 reduction gear as well as the main oil pumps for bearing lubrication and governor control.

Hydrogen-cooling system design provides a seal-oil circulating pump and cooler, an air-detraining tank and a vacuum tank for removing entrained gas from oil returning from seals and bearings. A cross-connection between the main-bearing supply header provides for operation during a seal-oil circulating-pump outage. Either generator may be opened for inspection or maintenance without interfering with hydrogen-cooling of the other. Condensate normally cools the hydrogen and is supplemented by salt-water cooling during the summer months.

Generators were originally rated at a total of 100,000 kw with 80% power factor and 0.5-psig hydrogen pressure. In operation, however, generator temperatures indicated these machines had considerable excess capacity. The manufacturer accordingly rerated them to 125,000 kw at 87% power factor

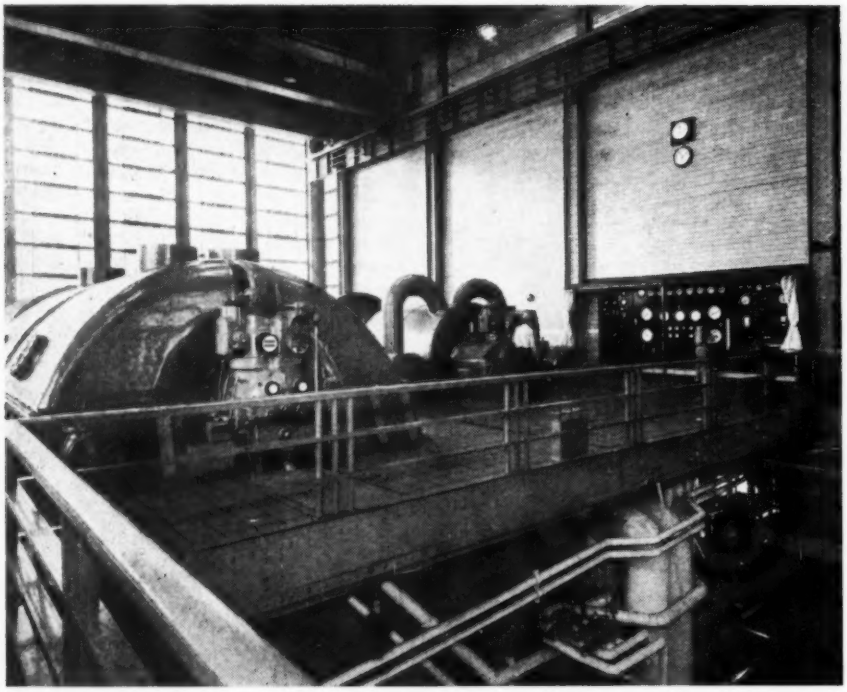


Fig. 3—Marion high-pressure-station turbine room with 62,500-kw 3600-rpm low-pressure turbine (consisting of two double-flow elements) at left, 62,500-kw 3600-rpm high-pressure turbine at center and the control board at far right

and 15-psig hydrogen pressure. Hydrogen detraining equipment was modified to take care of changed hydrogen conditions, but operation at higher pressure is necessary only during a few days in summer, when cooling-water temperatures reach their maximum.

Condenser. Built by Foster-Wheeler, the condenser is a single-pass design with a welded-steel shell and cast-iron water boxes. Its 55,000-sq-ft surface is made up of 18-gage ⅞-in.-OD 30-ft-long aluminum-brass tubes rolled at both ends. Tube sheets are of Muntz metal. Tube expansion is allowed by a stainless-steel diaphragm expansion joint between inlet-tube sheet and the shell.

Condenser longitudinal axis parallels the turbine shaft because the two low-pressure turbines are coupled in tandem. This makes possible the use of the unusually long tubes. Condenser has a wide steam space, which slowly narrows toward the bottom. Laning is about normal to the steam space periphery and several baffles are inserted which run nearly horizontal and tend to divide the space into four parallel condensers. Additional vertical baffles divide the condenser eight times along the tube length. Condensate in any of these elements falls to the nearest horizontal baffle. From here it is carried toward the shell, and then drains to the hotwell at the bottom.

Makeup water enters the condensate system through a horizontal header along one side of the condenser shell. Automatically controlled flow to the header maintains constant hotwell level, the header discharging into the steam space through numerous bottom perforations.

Heater drains return to the condensate system through the condenser. They are deaerated by passing through a perforated header to a series of trays in the steam-filled zone between the tube banks before mixing with the main condensate.

Air removal takes place in the lowest tube groups. These are baffled so that only noncondensable gas and vapor, which have passed through one of the condensing tube groups, can reach the entrance to the air-removal section. Two twin 2-stage steam-jet air pumps and two high-capacity single-stage ejectors for condenser evacuation connect to this section. An ejector is also provided for circulating-water-space priming. The unit is unusually tight, average air removal being one cfm.

Water System. A constant-speed motor-driven pump at 100-psi pressure passes deaerated condensate from the condenser storage hotwell to the steam-jet air pumps' inter- and after-condensers, then to the main-generator hydrogen coolers, exciter coolers and boiler-feed-pump motor coolers in parallel. Salt-water heat exchangers ahead of these coolers maintain predetermined maximum cooling-water temperature for midsummer operation.

From the generator coolers, condensate passes through a heater-drain cooler and No. 10-A closed heater, to which steam bleeds from the fourth stages of the low-pressure turbines, Fig. 7. From this heater the condensate enters the suction of the compound boiler-feed pumps. Primary element of each pump is a Worthington 4-stage horizontally split-casing centrifugal pump driven by a constant-speed motor through a hydraulic coupling. Speed is automatically controlled to maintain a differential of about 100 psi across the boiler-feed regulating valve. The secondary boiler-feed pumps are Worthington 5-stage barrel-type centrifugal pumps driven at 3600 rpm. The two boilers have two primary and four secondary boiler-feed pumps. Three of the latter are motor driven, the fourth being driven by a quick-starting steam turbine, which enters the system automatically upon failure of the boilers to obtain sufficient water.

The boiler-feed pumps discharge into the high-pressure feed-heating system consisting of four Foster-Wheeler closed heaters in series. All five heaters are vertical units. Two have integral drain coolers, and the two lower-pressure units have separate drain coolers.

High-pressure heater tube bundles are held stationary to the lower tube sheet, the shells being removed from the top. Tubes are ⅝ in. OD, 80/20 cupro-nickel mixture. Drains from the highest-pressure heater are cascaded to the next highest, and so on down through the last

Fig. 4—Discharge-water boxes of the 55,000-sq-ft single-pass cross-flow condenser, which is welded throughout

drain cooler. From here they discharge into the condenser steam space. Proper drain-cooler section submergence is maintained by Bailey air-operated drainer valves which receive their primary impulses from the level in the preceding heater.

High-pressure boiler makeup is entirely distilled and up to the present time has been supplied as a byproduct of the 200-psi station. However, for independent operation of the 1250-psi unit, two evaporators have been installed. These have horizontal shells and headers with continuous bent-tube coils, individually connected to the supply and drain headers. Evaporators are arranged to run either in single or double effect; steam supply may be from either the third or fourth turbine bleed point or the 200-psi header.

For superposed operation two Worthington deaerating heaters are added to the circuit ahead of the primary-feed pumps and all heater drains are pumped to them. Steam for these heaters includes the exhaust from any of the steam-driven auxiliaries, plus discharge from the evaporators. When this is insufficient an automatic pressure controller operates to admit steam from a higher bleed point. Conversely, this controller rejects excess steam to the lowest bleed point, thereby maintaining about 1.5 psi in the deaerating sections.

Steam Generators. Boilers are Babcock & Wilcox radiant units with 2-stage completely water-cooled furnaces, continuous-tube pendant-type superheaters and continuous-tube counter-flow economizers. Primary-furnace wall tubes are studded; floor tubes are studded and chrome-ore covered. Secondary wall tubes are bare. In selecting this design the primary desire was to reduce slagging to a minimum and cut maintenance costs while improving reliability. The furnace was proportioned so that gas travels about 70 feet and makes three right-angle turns before reaching the convection surface. Thus, ash particles are cooled before reaching the convection surface, and slagging in this area is minimized.

Furnace has continuous slag removal through a water-cooled hole in the floor center. Slag falls into a quenching tank, which empties into a second tank. From the latter the centrifugal ash pumps take their suction, discharging both slag and precipitated flyash into a storage area about 1000 ft from the boilerhouse. A float-controlled valve automatically maintains salt-water level in the ash-cooling tanks.

The centrifugal ash pumps are made of hardened cast iron and are rubber-fitted in places of greatest erosion. Discharge piping is 6 in. in dia, of either Ashcolite or Trenite.

Either six pulverized-coal burners or twelve fuel-oil burners fire the primary furnace through spaces between adjacent wall tubes. After combustion the furnace gas passes through the slag screen to the secondary furnace and through four rows of generating tubes into the superheater. A bypass boiler is built into the unit and parallels the superheater in the gas-flow circuit. Separate dampers for steam-temperature regulation control division of flow through these sections. The continuous-tube vertical-header counter-flow economizer is located at a point between the superheater and control dampers.

Furnace gas passes from economizer to Ljungstrom regenerative air heaters, then through Cottrell electrostatic precipitators on the boilerhouse roof before entering the induced-draft fan and passing to the stack. A constant-speed motor drives the single forced-draft fan per boiler through a hydraulic coupling. The induced-draft fan is driven directly by a 2-speed motor.

Fuel Supply. Coal or fuel oil normally reach the station in Hackensack River barges. Conveyor belts transport coal to reinforced concrete bunkers alongside the boilers. From here coal flows through weighing scales to the pulverizer feeders, their operation being controlled by the pulverizer-mill coal level. There are two pulverizers per boiler of the Hardinge or ball type, each of 16-ton-per-hr capacity. Pulverized coal is taken from the mills by a flow of preheated air, produced by an exhauster above each mill, and discharges into three pipes, which feed three of six burners per boiler. Finger-type dampers in the exhauster outlet boxes aid in distributing coal among the three pipes.

Instruments and Control. A Bailey Meter Co 3-element metering control regulates boiler-water level through an air-operated balanced-type valve in the boiler-feed pipe ahead of each boiler economizer.

A master controller of the Hagan combustion-control system connected to the main-steam piping develops an air-impulse pressure, which operates the pulverizer-exhauster dampers and varies the fuel-supply rate to maintain 1250 psig at the turbine throttle. A differential master controller connected between

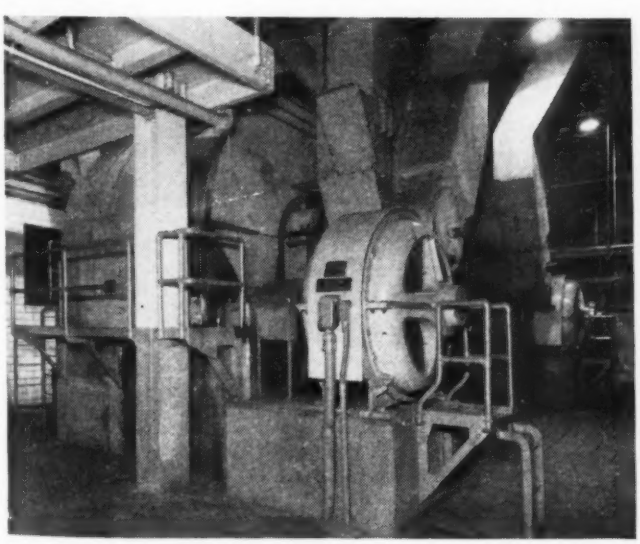


Fig. 5—Each boiler has two Hardinge-type ball-mill pulverizers with individual capacities of about 16 tons per hr

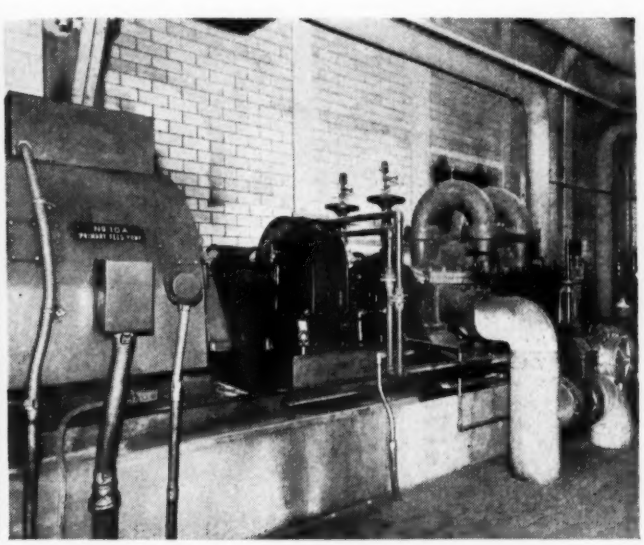


Fig. 6—One of the two primary boiler-feed pumps driven by a constant-speed motor through a hydraulic coupling

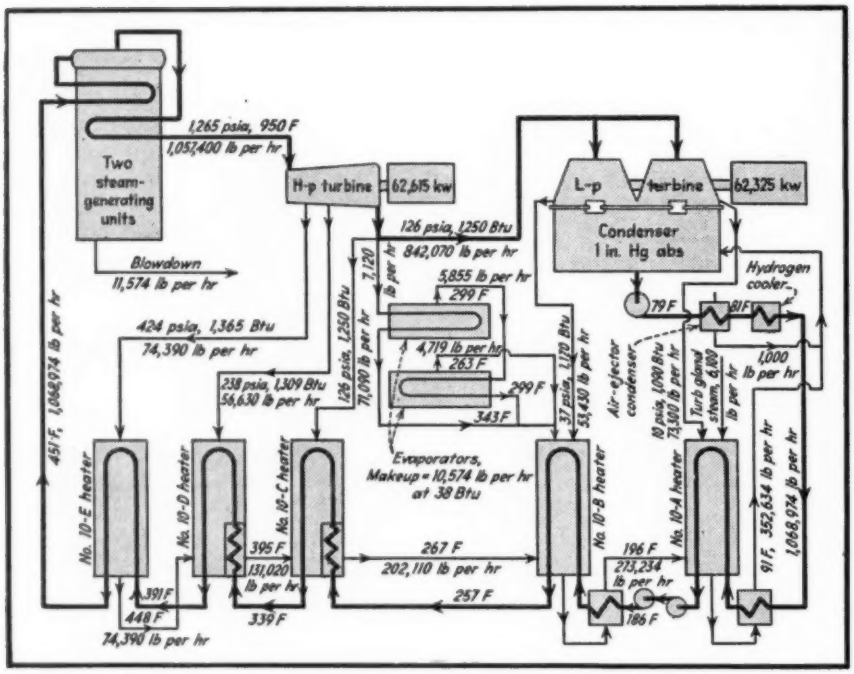


Fig. 7—High-pressure-unit heat balance at 124,940-kw load operating cross-compound has calculated net turbine-cycle performance of 8789 Btu per kwhr

main-steam drum and superheater-outlet header develops an air-impulse pressure that varies with steam flow. When corrected by actual air flow through the precipitator, this device controls the forced-draft-fan speed through the hydraulic coupling, thereby maintaining the desired CO_2. Manual fuel-air ratio adjustment compensates for changes in fuel characteristics. Steam-temperature automatic control was also provided but could not be operated as such because superheater surface proved to be in excess of normal requirements. Therefore other means of temperature control were required.

A pressure switch in pump-discharge header automatically starts the spare condensate pump. The spare circulating-water pump, during one-pump operation, is automatically started by a differential-pressure switch between condenser inlet and outlet water boxes. Automatic starting and control of Wallace and Tiernan intermittent chlorination system is initiated by a tide switch, which starts a 6-hour time clock at the low point of each tide reversal. The clock then controls the injection of chlorine solution to various river-water intakes.

Boiler-feed treatment is controlled manually with continuous recording and indicating of condensate, boiler-feed and boiler-water conductivity as an adjunct to laboratory analysis of samples every eight hours. Treatment comprises caustic soda, phosphoric acid and sodium sulphite, all continuously injected by a small reciprocating pump into the condensate flow at the primary boiler-feed-pump suction. High-pressure boilers are blown down continuously to maintain about 325 to 375 ppm total dissolved solids in the water. Blowdown enters a flash tank from which steam discharges to the auxiliary exhaust header. Condensate drains to the low-pressure station open heaters, forming at the same time water treatment for the 200-psig boilers.

Leeds and Northrup temperature recorders are provided for superheater outlet, turbine throttle, turbine exhaust and furnace gas. In addition a 75-point indicating instrument checks each element in the front row of each superheater. Recorders also are provided for measuring CO_2. Because of their operating importance each is checked daily against standard orsats.

OPERATING HISTORY

Neither turbine has been open for inspection since the initial start in June 1941. There is no immediate prospect of dismantling either machine, as the

(*Continued on page* 154)

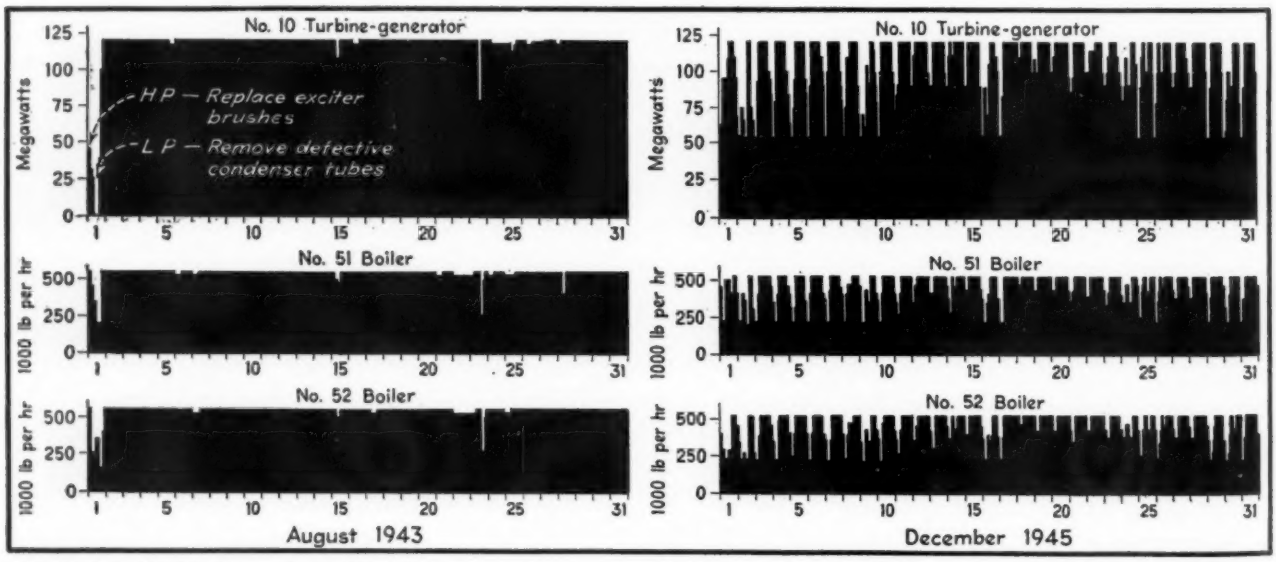


Fig. 8—Monthly load curves of Unit No. 10 turbine-generators and boilers showing type of service required of high-pressure installation. August 1943 is typical of loads carried during war; December 1945, present loading

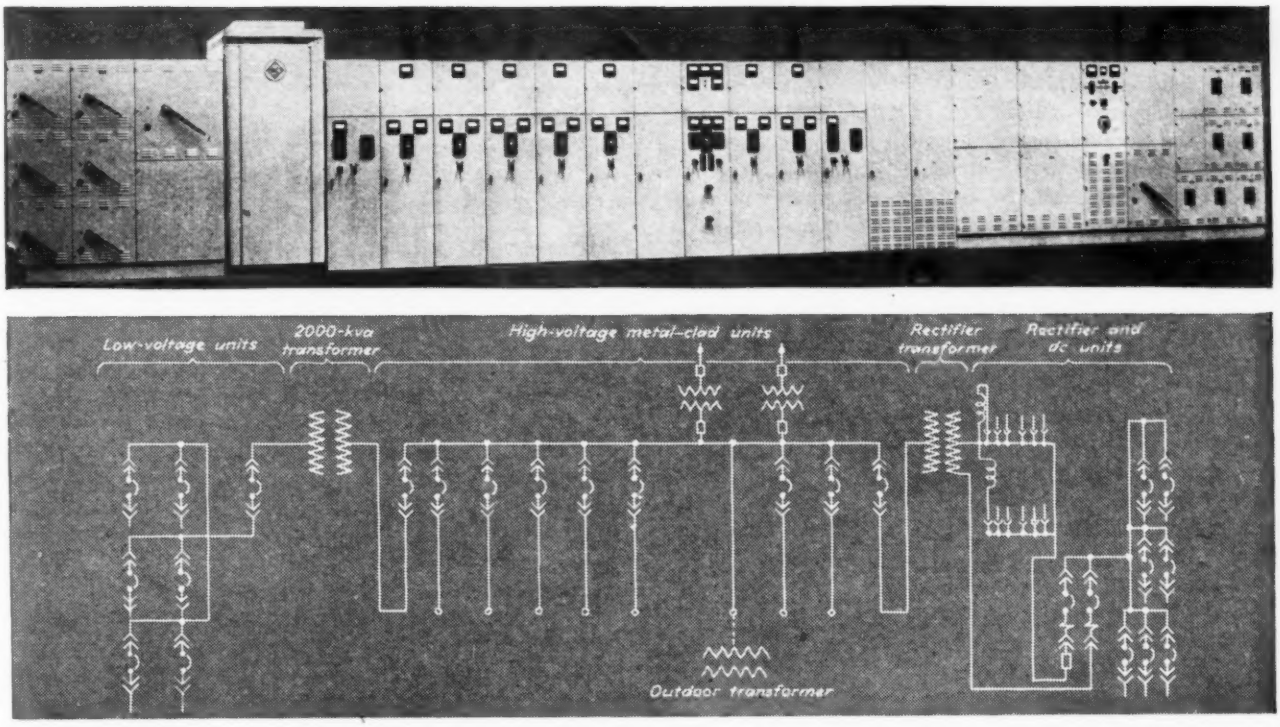


Fig. 1—This standardized load-center unit substation has proved to be the answer to the manufacturer's problem of supplying several small load distribution centers throughout the plant rather than installing one large substation

Standardized Unit Substations Help Solve Industrial Power Problems

Tried and accepted by the public utilities, unit substations today prove an important factor in solving industrial-plant electrical problems. L W Long, Allis-Chalmers Mfg Co, lists good dollars-and-cents reasons for this current design trend

▶ TODAY LOAD-CENTER UNIT SUBSTATIONS find wide use in both utility and industrial plants. Quick to appreciate the savings inherent in standardization and because of their continuing emphasis on safety and reliability, the public utilities led the way in adopting equipment that is interchangeable and readily replaceable. The power producers were also instrumental in promoting the development of metalclad switchgear, a basic part of the unit substation. The advantages of this equipment prove equally great in industrial applications and as appreciation of these advantages develops, unit substations find ever greater industrial use.

Unit substations are installed for good dollars-and-cents reasons. They save on original purchase because standardization enables manufacturers to fabricate equipment on a mass-production basis.

Further savings are realized from simplified engineering and purchasing, and because fewer spare parts are needed. If standardized equipment in distribution substations offers economic advantages, it is logical that savings are realized in industrial substations. If power users own these substations such savings are doubly apparent.

Growth of Unit Substations. Engineers and industrial purchasing departments often do not know as much about electrical-power equipment as utility companies. It is also economically impossible to have the large stock of spare parts that a utility must carry. Therefore, standard-equipment simplifies the industrial plant's buying problem.

Need for load-center unit substations has developed because of three major factors: (1) increasing mechanization of industrial plants (2) increased appreciation of voltage-regulation importance and (3) recent emphasis on saving critical materials.

Increased mechanization of industrial plants has resulted in multiplied power requirements. As load increased, a decision had to be made whether one large substation or a number of smaller ones would carry it. Continuity of service was important in dictating use of several smaller units.

Voltage regulation was another factor in adopting unit substations. Heavy power loads at low voltages cannot be supplied at great distance from substations because of voltage drop. Most practical solution was for Mohammed to go to the mountain—to place substation as near as possible to load center.

This also meant saving of material.

Savings in copper are in a sense proportional to the nearness of the step-down transformer to the load. Nor is this consideration one that passed with war's end because savings in material are reflected in cost reductions.

The manufacturer's problem was to supply a substation that would fill all these requirements, Fig. 1. Standardized load-center unit substation was the answer, and it was no wartime substitute for utilities had tested it in theory and practice for years.

Because of the great variety of industrial applications, substations require many sizes and types of equipment. Through standardization of dimensions, types and ratings, the load-center unit substation is possible.

Air Circuit Breakers. For distribution and control of power, metal inclosed low-voltage air circuit breakers are used, Fig. 2. This switchgear may be constructed with fixed breakers or with drawout breakers. Because of flexibility and maintenance ease, the drawout breaker is used in most installations. Operation can be electrical or manual. Since feeders from load centers usually supply equipment provided with starters or fuses, breakers open only the main circuit. Because breakers are small and operation relatively infrequent, manual operation is normally used.

Any standard protective devices, such as instantaneous overload, time-delay overload, undervoltage, etc, may be provided for the breakers. The protection generally depends upon the specific application.

INSTRUMENT MOUNTING

On larger units, panel space is available for mounting instruments. No such space is available on smaller breaker units themselves. In these smaller sizes all instruments are mounted on front panel of bus-transition compartment. Within it are connections to various bus levels whenever changes in levels occur. Virtually every load-center unit substation has at least one bus-transition panel, so instrument mounting space is available.

Unit substations are provided with two basic secondary-circuit arrangements. These are direct-connected, where the transformer is connected directly to the low voltage bus, Fig. 2, and are the cascaded-circuit type, Fig. 3, where a main-transformer secondary breaker is in series with all individual feeder breakers. With the direct-connected circuit, all feeder breakers must have interrupting capacity equal to maximum short-circuit current that can occur. With a cascaded circuit, the transformer secondary breaker must have enough interrupting capacity to clear the maximum fault, but the feeder breakers should have interrupting capacity equal to 50% of maximum short-circuit current.

For more than two or three feeder circuits, the cascaded arrangement is normally more economical in original investment. However, its use has one drawback. Since feeder circuits do not have interrupting capacities equal to the maximum fault, major faults re-

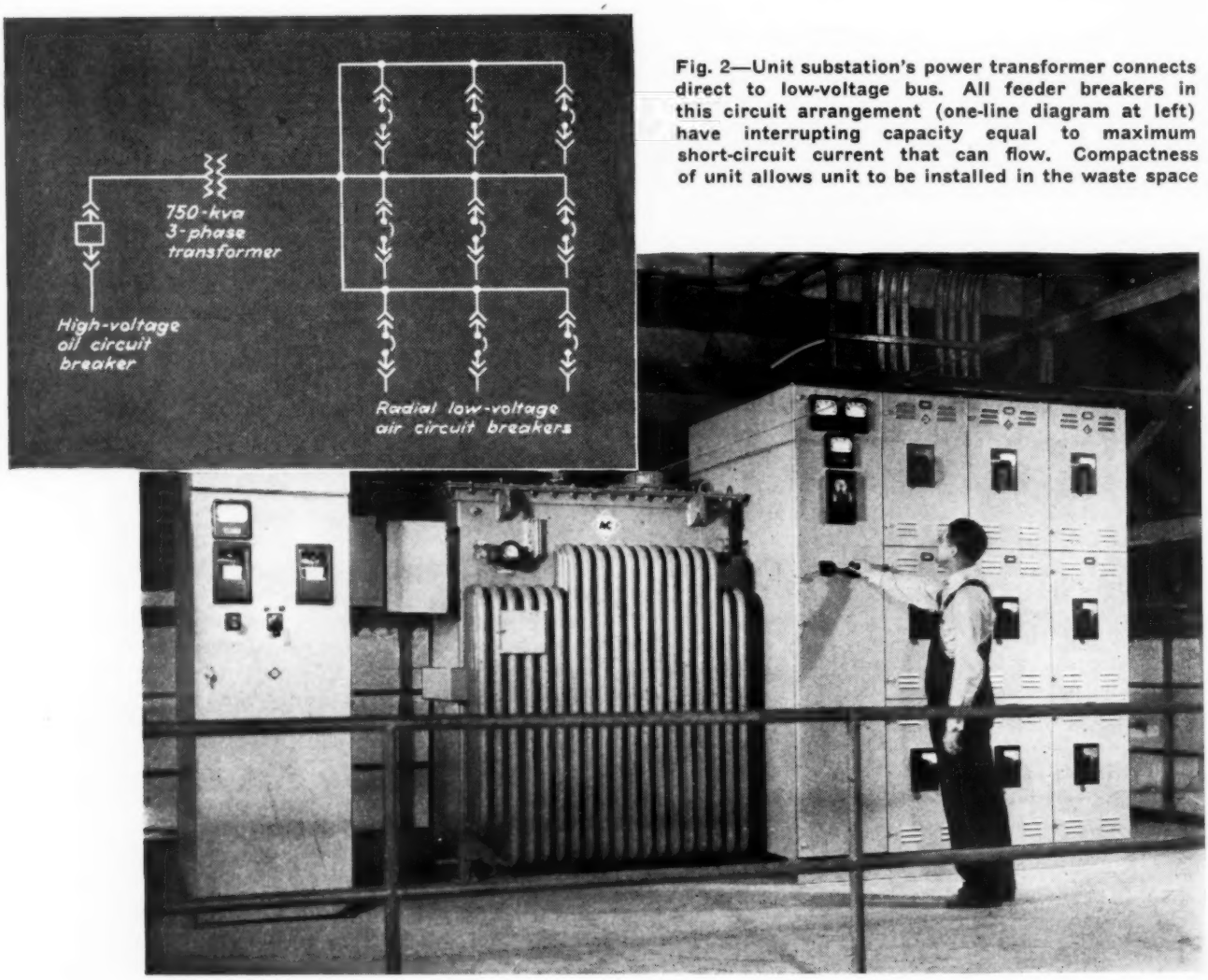


Fig. 2—Unit substation's power transformer connects direct to low-voltage bus. All feeder breakers in this circuit arrangement (one-line diagram at left) have interrupting capacity equal to maximum short-circuit current that can flow. Compactness of unit allows unit to be installed in the waste space

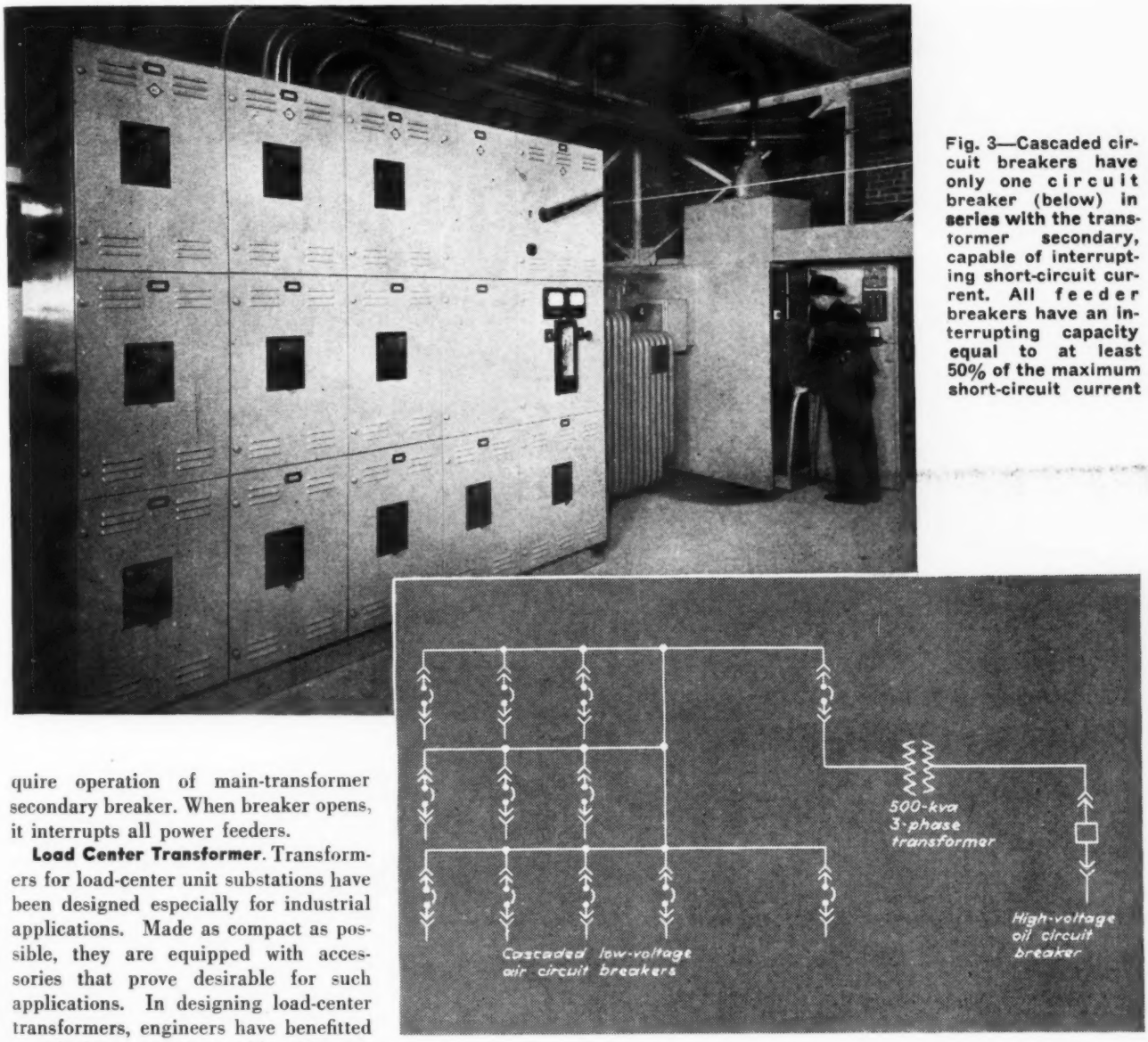


Fig. 3—Cascaded circuit breakers have only one circuit breaker (below) in series with the transformer secondary, capable of interrupting short-circuit current. All feeder breakers have an interrupting capacity equal to at least 50% of the maximum short-circuit current

quire operation of main-transformer secondary breaker. When breaker opens, it interrupts all power feeders.

Load Center Transformer. Transformers for load-center unit substations have been designed especially for industrial applications. Made as compact as possible, they are equipped with accessories that prove desirable for such applications. In designing load-center transformers, engineers have benefitted greatly from experience with utility network transformers. Standard load-center transformer is rectangular rather than oval, to give compact design and combine most suitably with metal inclosed switchgear. Each transformer is provided with tap changers. Liquid-filled transformers have a tap changer with handle brought out through the cover. Secondary connections are brought out through a throat on end of unit, which connects to switchgear. Core and coil construction is similar to network transformers.

INDOOR SERVICE

Since transformers in unit substations are near load centers, they are almost always used indoors. Thus, transformer has to be noninflammable, insulating, liquid-filled or dry type.

Standard load-center transformers vary from 100 to 2000 kva with primary voltages from 2400 to 13,200 and secondary voltages up to 600. This range fulfills virtually all well-engineered load-center applications.

As with much electrical equipment, there are no set rules for the application of load-center transformers. Size and number of units must be determined for each installation. If power is supplied to three widely separated buildings, for instance, each having about the same load, three transformers rather than one or two should be used.

Load-Center Installations. It is possible when installing load-center unit substations in existing plants that available space determines size and number of units. However, because of the transformer type and because it is completely metal-inclosed, load-center unit substations are not as often affected by this limitation as conventional substations. One large aircraft plant has six load-center substations in one building. Two are in the roof structure, two over foremen's offices, one over a storeroom, and one behind a washroom. Sizes range from 300 to 1500 kva. If additional load develops, new substations may be provided, or larger transformers substituted.

Type of load must be considered when deciding on size of units. One industrial plant has three production units, each requiring about 500 kva. Since they could operate independently, three 500-kva load centers were used. When only one production unit operates, two transformers are removed from the line. This reduction of losses was important in deciding on three units rather than one. Breaker-size reduction often proves an economical reason for a number of small load centers rather than one large substation.

CHEMICAL CLEANING Takes the Bull Work Out of Scale Removal: I

To prepare for solvent cleaning run temporary lines to a place where it is convenient for service truck to unload

Removing scale with solvents makes a job easier, and gives the equivalent of added capacity by reducing outage time. A summary of the chemical process with tips on precautions

The first of two articles on chemical cleaning discusses acid solvents and additive agents.—The Editor

► SCALE IN A BOILER or heat exchanger not only wastes fuel but, in the former, also introduces the chance of tube failure. Although all scales obstruct heat transfer to some degree, Table I, most of them are soluble enough to be removed by one or more of the many solvents available. However, chemical removal offers no cure-all because success depends to a great degree on scale composition. Occasionally a totally insoluble deposit can be removed only with mechanical tools.

Deposits difficult to dissolve are calcium sulphate, some silicates and refinery scale; however those containing certain percentages of calcium sulphate and about 80% of the silicate scales are removed satisfactorily. Scales with solubilities as low as 40% often can be loosened because the dissolving action on the soluble portion disintegrates the less soluble elements which are then flushed out. Exception is a laminated deposit of alternate soluble and insoluble layers. When the latter is reached chemical action ceases.

Numerous scales are soluble in inhibited hydrochloric acid to which have been added suitable auxiliary agents that increase the solubility of the scale and control the surface tension of the acid, and its reaction products. Surface-tension agents increase the acid's ability to wet the scale.

Some deposits require special chlorinated solvents while others need organic ones, indicating that one solvent is not effective on all substances. Alkaline and some organic cleaners remove oils and greasy dirt incorporated in scale, but the scale itself generally requires an acid cleaner.

Acid Characteristics. Commercial hydrochloric acid (28 to 32% hydrogen chloride by weight) proves better than sulphuric for scale removal because it reacts more favorably with scale-forming materials. It has other desirable qualities, Table II, such as: (1) ability to form water-soluble calcium-chloride compound in reacting with calcium carbonate—predominant in average scale (2) generally cheaper than other acids (3) readily available (4)

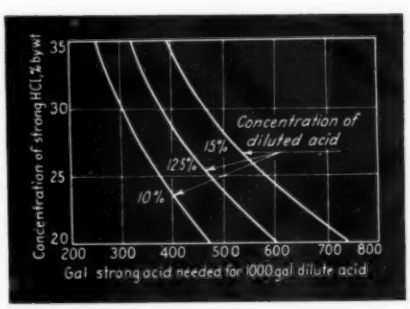


Fig. 1—Quantities raw hydrochloric acid that yield 1000 gal of solvent

By E W FELLER
Associate Editor, Power
and
GUY F WILLIAMS
Dowell, Incorporated

best all-around solvent for common scales (5) easy to handle (6) relatively harmless when compared to other acids (7) easily inhibited (8) ability to dissolve auxiliary agents without harmful reactions. Fig. 1 shows how much concentrated hydrochloric acid is required to make 1000 gal of cleaning solution.

TABLE I—HEAT LOSS CAUSED BY SCALE

Composition	Thickness, in.	Heat loss, %
Hard carbonate	1/50	5.4
Soft carbonate	1/32	7.2
Soft, mostly sulphate	1/16	10.8
Hard sulphate	1/9	15.9

TABLE II—COMPARISON OF TREATING ACIDS

Property	Hydrochloric acid	Nitric acid	Sulphuric acid
Cost	Economical	Relatively expensive	Economical
Inhibition	Easily inhibited	Difficult to inhibit	Easily inhibited
Hazard in handling	Very little	Causes serious burns	Dangerous to handle
Mixing with water	No trouble	No trouble	Large heat of dilution
Reaction products	Very soluble	Very soluble	Insoluble $CaSO_4$ formed
Additive agents	Many available	Little known	Little known
Speed of reaction	Rapid	Rapid	Fairly rapid
Usual commercial concentration	28–32%	52%	77–93%

TABLE III—HEAT EVOLVED IN THE REACTION BETWEEN HCl ACID AND LIMESTONE

	CO_2 liberated as gas	CO_2 dissolved in spent acid
Btu per lb of limestone	82.6	168.2
Btu per gal of 15% HCl	151.8	309.1
Temperature rise in spent acid, F	20.1	41.0

ACID REACTION

Sulphuric acid reacts with calcium carbonate to form an insoluble calcium-sulphate granular precipitate, which does not dissolve in acid but must be flushed out of the vessel. If the calcium carbonate is a hard, adherent scale the acid may cover the surface with an insoluble coating and prevent further action. When highly concentrated (98 to 100%), sulphuric acid can be stored in steel drums without adding inhibitors, but when diluted to 10 or 15% concentration it corrodes metal about the same as uninhibited hydrochloric. Therefore when diluted, both acids require inhibitors. From a handling standpoint sulphuric acid, both concentrated and diluted, is more harmful to the skin and eyes than hydrochloric.

On minerals such as iron oxide, often found in scale, hydrochloric acid reacts more readily than sulphuric because of the solubility of the resulting salt. Sulphuric acid and iron oxide form ferrous sulphate having a solubility of 15.68 grams in 100 cc of water, whereas with hydrochloric acid, ferrous chloride is formed having a solubility of 160 grams in 100 cc. Both acids have about the same action on silicate scale, neither being very good; however, when the material is porous and finely divided, hydrochloric dissolves more. Only good solvent for silicate scale is hydrofluoric acid. Because fluoride salts are easier to handle they are usually mixed with hydrochloric acid to form hydrofluoric acid according to requirements.

Tests show few scales that can be removed with sodium hydroxide if they are insoluble in hydrochloric acid. One exception is a porous, nonadherent iron oxide, carbonate or like material, which would not be dissolved but might be washed off in the same manner that soap and water remove dirt from the hands.

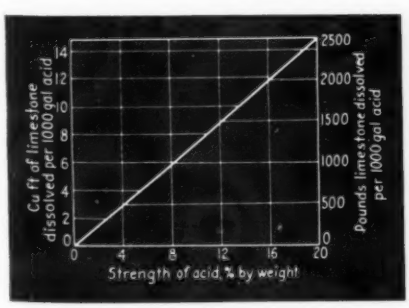


Fig. 2—Amount limestone dissolved by 1000 gal 0-20% hydrochloric acid

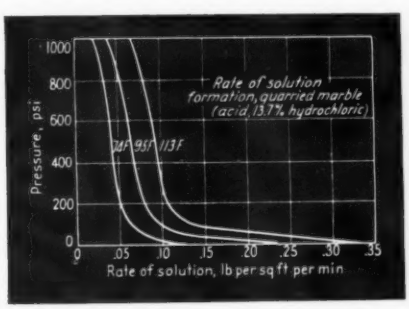


Fig. 3—Effect of pressure and temperature on reaction of acid, marble

Phosphoric acid offers certain advantages but is not always readily available.

When hydrochloric acid contacts calcium carbonate the reaction produces calcium chloride, carbon dioxide and water. Because calcium chloride dissolves in water and CO_2 passes off as a gas the calcium carbonate is removed as a liquid. Assume a treating solution contains 15% hydrogen chloride by weight and has a specific gravity of 1.075. In 1000 gal there are 1000x8.333x 1.075x0.15 = 1343.2 lb of hydrogen chloride. By calculation this amount of solvent dissolves 1840 lb of calcium carbonate, Fig. 2, to form about 2042 lb of calcium chloride, 331 lb of water and 809 lb of CO_2 in a spent solution of 1.181 specific gravity.

HEAT GENERATED

Formation and solution of the compounds involved in the reaction of 15% hydrochloric acid and calcium carbonate generates 82.6 Btu for each lb of the substance dissolved, or 151.8 Btu for each gal of acid neutralized. These figures hold true only when the reaction

takes place at low pressure and the CO_2 escapes as a gas. If pressure is high and CO_2 dissolves in the spent solution, heat of reaction is about doubled, 168.2 and 309.1 respectively, Table III.

Chemical reactions that form gaseous products are retarded as the pressure increases and can be stopped entirely if the applied pressure is extremely high. The pressure required to stop the reaction is many times greater than anything ever encountered in actual practice. Reason is that increased pressure prevents free evolution of CO_2 and thus it concentrates in the spent solution. Fig. 3, for a 13.7% hydrochloric-acid solution and calcium carbonate, shows how the solution rate decreases rapidly as pressure increases up to 100 psi. From then on, pressure effect becomes less. The curves also show that solution rate increases with temperature.

Value of Inhibitors. Successful application of chemical cleaning was made possible by the discovery that adding certain substances (inhibitors), Table V, to the solvent controlled its attack on metal. Of all those listed the best inhibitors contain arsenic, sulphur or nitrogen, generally in the form of organic compounds. The latter may be pure compounds, controlled mixtures, natural products or some modification. Inhibitors are sold under various trade names but the names give no indication of the constituent's ingredients or effectiveness.

INHIBITOR EFFECT

Some inhibitors are more effective on certain metals than others. Presence of brass, bronze, cast iron, steel and other alloys must be considered. Base metal as well as scale characteristics influence choice of inhibitor. Properly inhibited solvent does not cause dezincification of Admiralty metal. Action is to dissolve both copper and zinc uniformly. There is much less danger to Admiralty metal than steel, Table IV. For instance, in cleaning a condenser having cast-iron water boxes, steel tube sheets and Admiralty-metal tubes, vulnerability is in the order named.

Raw hydrochloric acid attacks iron or steel to form iron chloride and hydrogen and its action is more rapid at high temperature than at low. But by adding a small quantity of proper inhibitor to the acid its corrosive effect on metal can be reduced about 99%, Fig. 4, without noticeable change in its action on scale-forming material. Oddly enough the inhibited acid dissolves iron oxide as well as scale. Even with inhibited acid there is still some attack on the metal. But the action is slowed

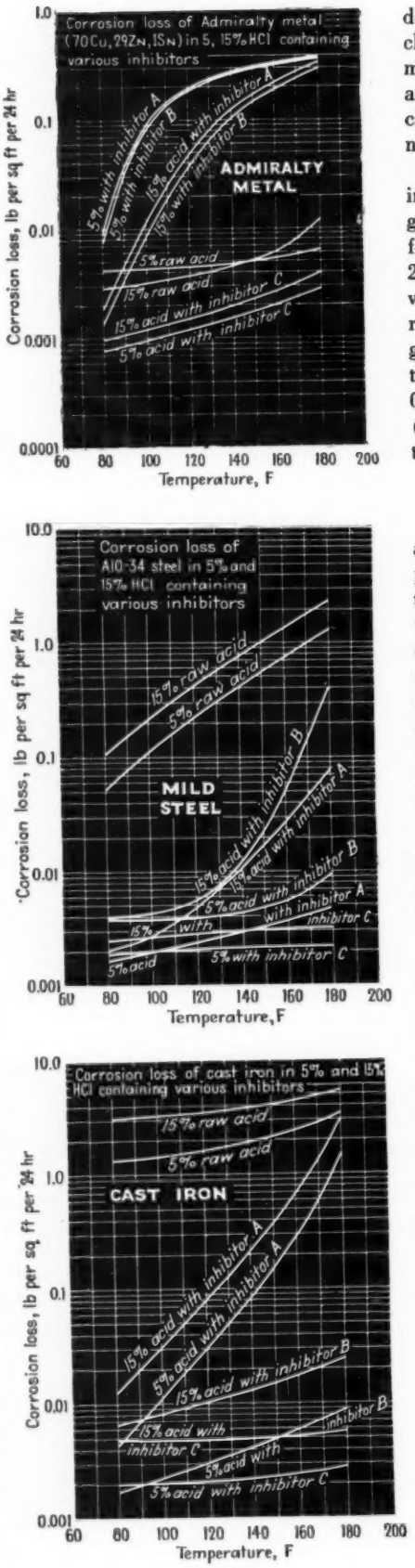

Corrosion loss of Admiralty metal (70Cu, 29Zn, 1Sn) in 5, 15% HCl containing various inhibitors
ADMIRALTY METAL
5% with inhibitor A
5% with inhibitor B
15% acid with inhibitor A
15% acid with inhibitor B
5% raw acid
15% raw acid
15% acid with inhibitor C
5% acid with inhibitor C
Corrosion loss, lb per sq ft per 24 hr
1.0
0.1
0.01
0.001
0.0001
60 80 100 120 140 160 180 200
Temperature, F
Corrosion loss of A10-34 steel in 5% and 15% HCl containing various inhibitors
MILD STEEL
15% raw acid
5% raw acid
15% acid with inhibitor B
15% acid with inhibitor A
5% acid with inhibitor A
5% acid with inhibitor C
10.0
1.0
0.1
0.01
0.001
Corrosion loss of cast iron in 5% and 15% HCl containing various inhibitors
CAST IRON
15% raw acid
5% raw acid
15% acid with inhibitor A
5% acid with inhibitor A
15% acid with inhibitor B
5% acid with inhibitor C

Fig. 4—Corrosion loss of Admiralty metal, mild steel and cast iron in 5 and 15% raw hydrochloric acid; and also using same acid strength with various inhibitors. In general, corrosion increases at elevated temperature

down to a point where the physical and chemical characteristics and life of the metal are for all practical purposes unaffected. The same boiler after ten cleanings showed no visible signs of metal loss or hydrogen embrittlement.

To check metal lost from a boiler during cleaning the total amount of hydrogen evolved was measured on three different units. They were preheated to 200 F and the inhibited acid-base solvent introduced at 175 F and allowed to remain in the boilers for 6 hr. Hydrogen content of the gas evolved showed the corrosion rate to be 0.010, 0.019 and 0.018 lb of metal lost per sq ft per day (24 hr). Reduced to 6-hr treating time the loss is almost microscopic.

ACTION IN SOLUTION

Action of an inhibitor is based on its attraction to the iron because of the presence of unlike electric charges on the two materials. In hydrochloric acid the hydrogen ion carries a positive charge and the chloride ion a negative one. When iron dissolves in the acid, iron ions each having two positive charges go into solution. Two negative charges, which originally balanced the two positive charges in the iron atom, remain on the metal surface. One iron ion going into solution collects two chloride ions because the former carries two positive charges. Thus iron chloride is formed.

When the two chloride ions are removed from the hydrochloric acid, two hydrogen ions, each carrying one positive charge, are made available to combine with the two negative charges left on the iron surface. Neutralizing these charges forms a molecule of gaseous hydrogen on the metal; this molecule soon combines with others to form a gas bubble that floats to the surface. Iron ions would rather go into solution and combine with chlorine than stay with the parent metal. One way to slow down this corrosion is to prevent the hydrogen ions coming in contact with the iron surface. Proper chemical inhibitors do this.

HOW THEY WORK

The molecules of inhibitors, although electrically neutral when taken as a whole, have more negative than positive charges at one end, and vice versa. They are known as polar molecules because they have a positive and negative pole. When iron ions leave the metal and go into solution negative charges on the iron surface set up an electric field that attracts the positive ends of the inhibitor polar molecules. This attachment balances the iron's negative

TABLE IV—CORROSION LOSS BY HCl ACID, LB/SQ FT/DAY

	Inhibited Hcl Acid						Raw Acid
	100 F		150 F		175 F		150 F
	5%	15%	5%	15%	5%	15%	15%
Steel	0.0021	0.0025	0.0033	0.0182	0.0046	0.0571	1.232
Cast iron	0.0118	0.0316	0.130	1.161	2.683	1.143	.....
Admiralty metal	0.0010	0.0013	0.0020	0.0023	0.0022	0.0032	0.00754
Copper	0.00035	0.00059	0.00074	0.00084	.....	.....	.....
Stainless steel	.....	.....	.....	0.00448	.....	.....	0.594
Brass	0.0003	0.0004	0.0005	0.0007	.....	.....	0.0025
Bronze	0.0012	0.0006	0.0012	0.0008	.....	.....	0.0025

charge and forms a thin film on the surface, similar to roof shingles. The actual protecting effect appears to be mechanical, the film showing a barrier impervious to hydrogen ions.

Corrosion Hazards. Ferric iron in the solution comes from the solvent dissolving iron scale or rust and is a potential source of corrosion not prevented by inhibitors. If the scale contains appreciable amounts of ferric iron it may, under certain conditions, combine with the solvent to form ferric (iron) chloride. Some of the latter may then unite with metallic iron of the vessel to form ferrous chloride. One way to prevent this corrosion is to add enough fresh solvent to hold the ferric iron content down to a low figure.

SECOND POSSIBILITY

Another possibility of unrestrained corrosion to iron equipment occurs if the solution contains an appreciable quantity of dissolved copper, which comes from dissolving scale high in the carbonate or other soluble copper salts in copper equipment. It does not come from acid attacking metallic copper parts of the vessel. Hydrochloric acid converts these salts to copper chloride and this in turn reacts with metallic iron of the vessel to take iron chloride into solution and plate out metallic copper. Action continues until all copper is plated out of solution. Best protection against this form of corrosion is to add solvent and discharge the solution until the copper concentration drops to a safe value.

Some boilers contain copper either in the form of pure metal or an oxide. Theoretically, inhibited acid dissolves the oxide but not the metallic copper and any oxide dissolved may later plate out on boiler surfaces. However, in boilers with scale containing 15 to 30% copper oxide no plating has been apparent, but some is precipitated as sponge copper, easily washed from the boiler. There is little assurance that inhibited acid dissolves copper plating, but solutions are available that dissolve it without injuring boiler metal. Many times disintegration of the soluble scale or oxides remove it.

On units where scale-to-water-volume ratio is high and where there is high iron or copper content in the scale, usual practice is to treat the vessel in a single pass—do not recirculate the solvent. Treat all-copper units by single pass because the scale is high in copper compounds. Vessels containing brass, bronze, Admiralty metal or other copper alloys and those in which the scale is not high in copper or iron compounds can be cleaned by circulating the solvent if other factors indicate circulation necessary. There appears to be no cause for concern about electrolytic action between dissimilar metals in the same vessel when they are being cleaned chemically because contact time is too short.

Gas Dangers. Other points that deserve consideration are the evolution of hydrogen (acid attack on steel) and hydrogen-sulphide gas (acid action on iron-sulphide scale). Vessel being cleaned must be kept closed (manholes and handholes) and vented to the outside so that absolutely no gas can enter the building or pocket to cause trouble. A violent explosion, apparently caused by accidental ignition of hydrogen, occurred during the acid cleaning of a condenser. Acid evidently leaked into the steam side and reacted on the clean iron during the soaking period.

HIDDEN DANGER

Hydrogen sulphide gas overcomes without warning. In one instance the volume liberated was greater than anticipated and several workmen were overcome before the vent could be submerged. When the presence of this gas is expected, carry the vent line to a 50-gal barrel or other vessel filled with water into which has been mixed 50 to 100 lb caustic soda or soda ash. Gas reacts with the alkali and is destroyed. Keep a constant check on the solution and renew it when necessary.

Before introducing acid cleaner into a vessel service companies use a kit similar to Fig. 5 to test inhibitor action. Unit consists of a wide-mouth bottle fitted with a rubber stopper and a large vent bulb into which is sealed a U-tube manometer. With manometer filled with

TABLE V—MATERIALS SUGGESTED AS HAVING INHIBITING PROPERTIES

1. Acid resins, 8 or more
2. Alcohols; 676 commonly listed include: (a) amyl, 8 or more; (b) butyl, 4 or more; (c) ethyl; (d) methyl; (e) propyl; (f) higher alcohols, large number
3. Aldehydes, 81 commonly listed
4. Cellulose pulp waste, comprises many different compounds
5. Crude anthracene
6. Cyanides, 91 inorganic and 87 organic commonly listed
7. Distillate from gelatin
8. Distillate from gelatin with fats
9. Gelatin
10. Glycerin
11. Hydrocarbon tars, many hundreds, number indefinite
12. Liquid obtained from bran
13. Liquid obtained from starchy material, number indefinite
14. Nitrogen ring compounds, many thousands 2290 parent ring system and 1720 pyrols already identified
15. Organic bases, meaning indefinite, over 1000 commonly listed
16. Pyridine bases, more than 700 commonly listed
17. Remains from distillation of anthracene
18. Residues from distillation of organic compounds, indefinite number; may include thousands
19. Residues from production of naphthalene
20. Sodium bisulphate
21. Sulphite lye
22. Sumac leaves
23. Waste acids from refining hydrocarbons, number and meaning indefinite; may include thousands

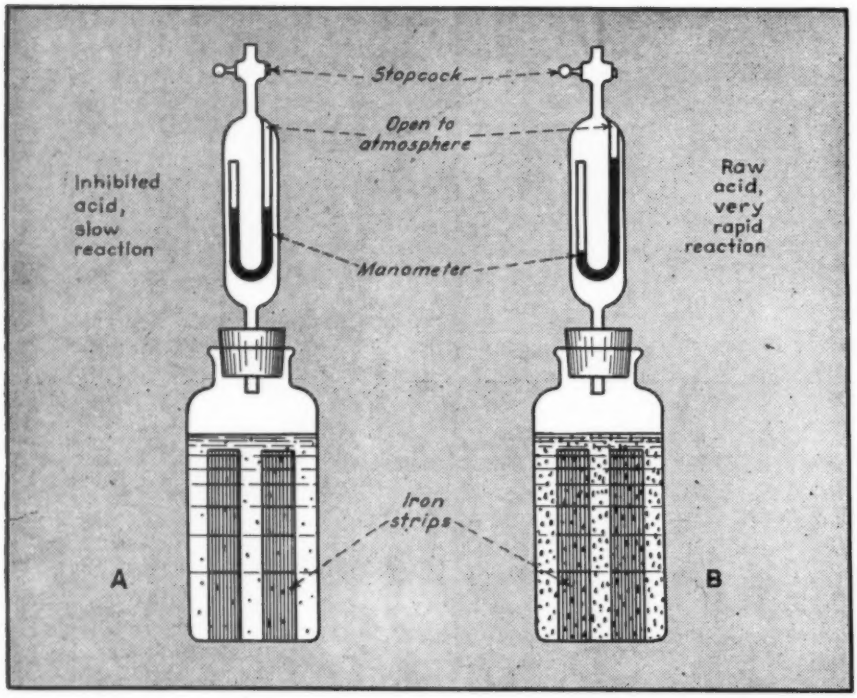


Fig. 5—With inhibited acid A, manometer level is not visibly affected, but raw acid B produces hydrogen rapidly and an appreciable pressure is registered

water and vent stopcock closed, amount of hydrogen gas generated by acid attack on the metal can be measured. In making test, the strips of metal are sandblasted to clean them of rust, mill scale and grease. When comparing inhibited with raw acid or different samples of inhibited acid use equal amounts for each test. When making raw-acid test the stopcock must be left open or pressure will empty the U-tube. A good inhibited acid evolves hydrogen slowly; when comparing several samples allow considerable time for the test.

Expediting Agents. Many other agents when added to the solvent expedite the chemical reaction between acid and scale. One material (foaming agent) agitates the solution by causing it to foam while another (retarding agent) slows up the process when scale and acid react too rapidly. A sustaining material holds dissolved solids in solution so they do not redeposit. A mixture of highly active solvents is capable of dissolving silica, bentonitic and certain types of sulphates.

Intensifiers speed up chemical reaction. This may be done by: (1) increasing solvent concentration (2) raising solvent temperature (3) adding a positive catalyst. Practicability and time allotted for the job determine which method is best. For instance, the first two may be adaptable to mechanical equipment, but not to water wells. Here method (1) increases the viscosity and concentration of the spent solvent to such an extent that the solution is difficult to remove from the producing formation. Also the concentrated byproducts may reprecipitate in the strata pores and thus reduce water flow. Method (2) is impracticable on water wells because high rate of heat exchange from solvent to piping and surrounding earth cools the solvent before it reaches the producing formation. However, magnesium rods can be used to heat the solvent at bottom of well. (This method will be discussed in second article.)

Optimum cleaning temperature for boilers and heat exchangers, using a good inhibitor, lies between 130 and 160 F. Within certain limits it is a critical factor in chemical cleaning because corrosiveness of inhibited acid, Fig. 4, and solubility of certain scales and corrosion products increase with elevated temperature. Carbonate deposits generally do not require a heated solvent as do phosphates, sulphates, oxides and silicates. Deposits vulnerable to hydrochloric-acid solutions can be removed at 130 to 160 F—temperatures well within the safe inhibitor range.

WETTING AGENTS

Wetting agents reduce the surface tension of a liquid (give it greater wetting power) so it comes into intimate contact and penetrates fissures in the scale more readily. Surface tension is the force acting parallel to the body surface tending to diminish its extent. Mercury has a higher surface tension than water as shown by shape of the meniscus in a glass tube. Molecules at the liquid surface are attracted more strongly to adjacent ones within the liquid than they are to those of a foreign substance outside. These attractive forces draw the liquid into a body having the least ratio of surface to volume, such as obtains in a spherical drop. A wetting agent overcomes these attractive forces and increases the surface area of the solvent.

Surface-tension lowering agents must remain active after the cleaning solvent is spent, especially in water-well treatment because CO_2 gas evolved in the reaction comes out of solution when the spent acid returns to the well bore. These gas bubbles form in the strata fissures, block the returning solvent and sometimes reduce well production. A wetting agent that retains its strength in spent solvent prevents this trouble.

If You Bind Your Copies of Power . . .

All McGraw-Hill magazines, with the exception of *Business Week*, *Electrical Merchandising* and *Science Illustrated*, are adopting a standard 8¼x11¼-in. page size starting with this September issue. We regret that the paper shortage makes the change necessary during the course of the year. We should have preferred, for your convenience if you bind the year's issues, that the change be made in January.

However, we are sure your binder will be as willing and able to meet the situation as ours is. The issues of September through December can be filled in at the stitching edge to equal the remainder of the year in width. Top and bottom margins of the first eight months are sufficiently wide to allow for trimming to the new length. We anticipate that this temporary inconvenience will be more than equalized by the advantage of a standardized size henceforth.

Avoid False Security by Careful Selection and Testing of Safety Valves

Basing your selection only on physical size and operating pressure without regard to discharge capacity may jeopardize life and property. Here are facts on installation practices, performance and tests to keep safety valves in A-1 condition

By W E ROSSNAGEL
Safety Engineer
Consolidated Edison Co of N. Y., Inc.

▶ ALTHOUGH SAFETY VALVES are attached to pressure vessels to relieve dangerous overpressures it is surprising how frequently they are selected haphazardly and ignored after installation. Even some design engineers are inclined to treat them rather lightly. In fact, we often see a drawing for installation of a pressure vessel that contains the note "Provide one ½-in. safety valve set at 100 psi", without stipulating the necessary relieving capacity.

The table of safety-valve capacity tests, published by the National Board of Boiler and Pressure Vessel Inspectors, indicates that safety valves of various makes and models, when set to open at a certain pressure, discharge widely different quantities of steam, Fig. 2. Keep in mind they are 100-psi valves and would meet the requirements of the above note on a drawing. Thus, merely specifying the structural size does not suffice, and the discharge curves, Fig. 2, show why. Another important point to consider is the kind of fluid to be discharged because the type affects valve capacity, Fig. 3.

Popping Pressure. When used on steam, air or gas service a safety valve should be set to open at a pressure not in excess of the designed working pressure of the equipment it protects, or not more than 20% above normal working pressure, whichever is less. Thus, a boiler designed for 100 psi, but now used only for heating a building that requires a maximum working pressure of 15 psi, should have a safety valve set at 18 psi, not 100.

According to the *ASME Boiler Code*, always install safety valves without stop valves on the inlet or discharge piping, because the accidental or intentional closing of such valves renders a safety valve useless. This Code requirement is as it should be. However, in the chemical industry, a difficult situation frequently exists. In some processes it is impossible or impracticable to shut down operations, yet gummy residues precipitate inside the piping, including the safety valve, which may thus be rendered inoperative after a short period of time.

Chemical Plant Practice. In such plants it is quite common to see stop or block valves placed between pressure vessel and safety valve. Chemical engineers recommend shutting the block valve for a half hour once a month, during which time the operator maintains extra vigilance at his pressure gages, to permit a mechanic to inspect, clean and test the safety device. They believe this practice far safer than to prohibit installation of the block valve and continue to operate for weeks or months with a safety valve so gummed up that it probably will not work. The block valves, when installed, are always sealed open and routine inspections made to ascertain that seals remain intact.

Valve Classification. Safety valves are made in two general types: (1) relief valves used on liquids and (2) pop or pop-safety valves on vapors or gas. The second are often called simply safety valves.

The relief valve, Fig. 1*A*, is a spring-loaded device designed and adjusted to open at predetermined hydraulic pressure acting on under side of disk. This pressure is resisted by the spring. Only a relatively small quantity of liquid ordinarily passes through the relief valve before the pressure in the vessel falls and the valve reseats. Closing

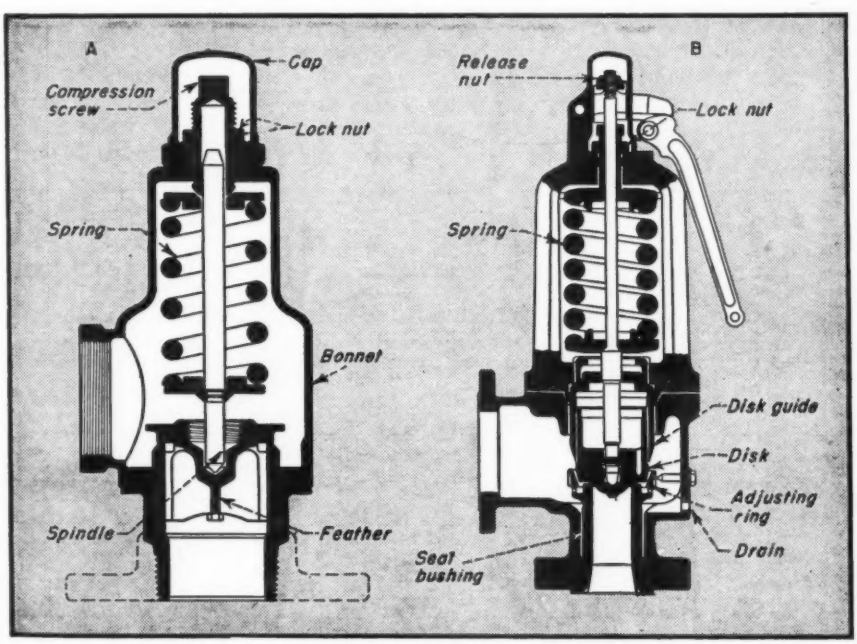


Fig. 1—A: Relief valves (used on liquids) close almost exactly at the opening pressure. B: Pop valves (used on vapor and gas) lower the pressure noticeably

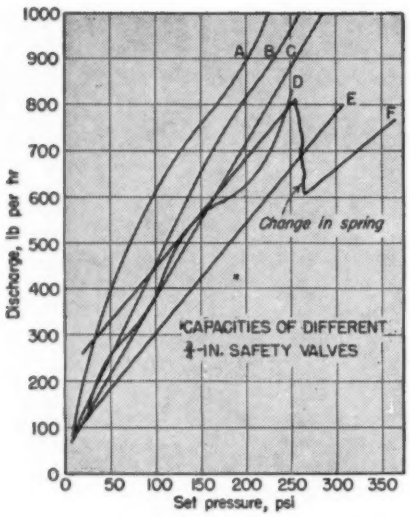


Fig. 2—Discharge capacity of different valve types varies over wide range

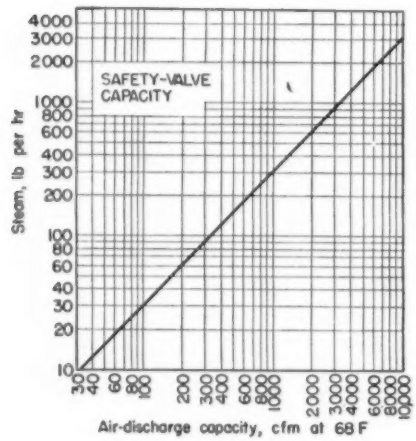


Fig. 3—In shifting valve from steam to air, or vice versa, use this curve

takes place almost exactly at the opening pressure. It requires a built-up or accumulated pressure of about 25% above the opening pressure to lift the valve disk to maximum opening.

The pop valve, Fig. 1*B*, may have the same type of valve body; in fact, it may be impossible from an exterior inspection to distinguish between a relief and pop valve of the same size. However, a set screw in the rear of the valve body, which holds the blowdown ring in adjustment, usually identifies a pop or pop-safety valve. The fluid which passes the valve does not discharge freely as in a relief valve, but is trapped in an annular space known as a *huddle* chamber.

In construction the valve disk has a flange extending beyond the diameter of the seating contact; sometimes it is cupped downward slightly. A blowdown ring surrounding the valve seat, fits quite closely around the valve-disk flange. Thus, when the fluid escapes through the valve seat, it enters this blowdown chamber and exerts a lifting pressure upon a much greater area of the valve disk. This readily overbalances the spring and instantly opens the valve wide with a loud *pop;* hence the name.

When vessel pressure falls to not more than 4%, or 2 psi below the opening or *set* pressure, the valve snaps closed again. While blowing, a pop valve should not allow a buildup of more than 5% above set pressure.

Safety-Valve Installation. On many high-pressure centrifugal fire pumps a relief valve is installed to bypass water from the discharge back to the suction side if all hose nozzles happen to be shut off. In such installations the back pressure (in psia) should not exceed 25% of the relieving pressure (in like terms). The relief valve is set to open at the difference in the two pressures. For instance, if the fire pump operates at 100 psi and positive pressure in the suction pipe is 25 psi, the difference in pressures would be 100 − 25 = 75 psi, which is the pressure the relief valve is set to open.

A relief valve for liquid service is usually located below the top of the vessel it protects. It may, however, be placed on the piping a short distance from the vessel; for longer distances the connecting pipe must be larger than the nominal size of the safety device. If the vessel is tall and the relief valve located considerably below the liquid level, the hydrostatic pressure (0.434 psi for each foot below liquid surface) must be added to the vapor pressure in determining the set pressure at which the valve is to lift.

On the other hand, good practice dictates that a pop valve, for gas and vapor service, be mounted directly on the highest part of the vessel it protects. It may, however, be located on the piping above the vessel but close to it. If mounted on a tee at a right angle to the pipe, the latter should be much larger than the nominal size of the safety valve to insure free flow of the fluid.

Discharge pipe for a safety valve should never under any circumstances be smaller than the valve. It should, where necessary, be protected from freezing. Pop-valve discharge lines that terminate outdoors usually have rain hoods over the outlets. When used in steam service, provide a drain hole in the elbow at the valve outlet.

If the protected vessel is liable to be exposed to a serious fire which might envelop it, install a safety valve capable of relieving the greatly increased quantity of vapor that may thus be unexpectedly produced. Do not install bronze valves where the temperature is liable to go above 300 F.

Testing Safety Valves. Test valves at least once a year, and more frequently if conditions warrant. This ordinarily makes it unnecessary (except as required by law) to raise the lifting lever periodically, on units so designed, as periodic testing is far more beneficial than periodic tripping. Maintain a record of each test.

When preparing to test a safety valve be certain there is no pressure in the vessel or piping that mounts the valve. If there is a block valve under the safety valve, good practice dictates that the former be closed by the operator only after breaking its seal in the presence of the test mechanic. If there is

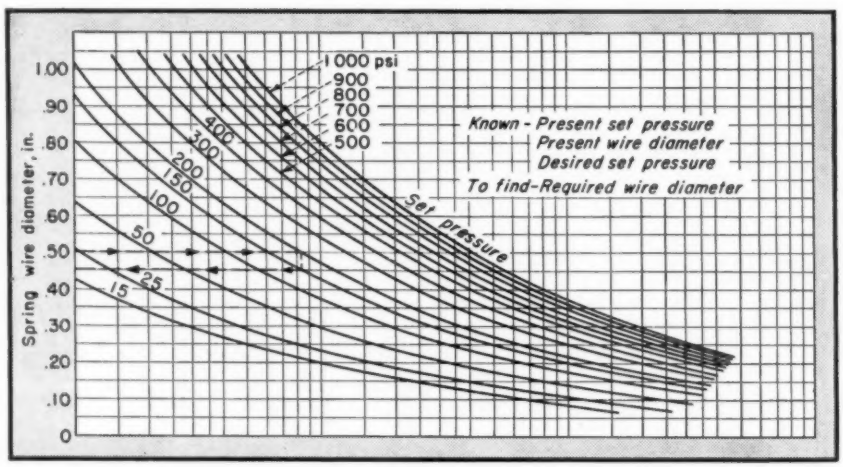


Fig. 4—Follow course of arrows from initial spring-wire size to initial pressure line, then vertically to new pressure and horizontally to new wire size

no such valve have an operator present when the mechanic removes the safety valve.

Inspection Procedure. After removing a safety valve, clean it in a degreaser using trichlorethylene vapors, or wash it in the liquid to remove all traces of grease and objectionable chemicals. A small degreaser can be made in the shop without too much difficulty.

On the test plate, place a piece of live rubber, about 9 in. dia and $\frac{3}{16}$ in. thick, having a $\frac{1}{2}$-in. hole in its center to fit over the air inlet. Place the safety valve on the gasket, if it is of the flanged type; otherwise screw it into a flange of proper size and place the latter on the gasket. By means of two or four finger clamps and the $\frac{7}{8}$-in. studs, clamp the valve to the test plate.

Using a needle valve, admit air slowly and watch the pressure gage (Its hand should seldom, if ever, be made to move past the halfway mark on the dial.) until the safety valve opens, and note the pressure. If a relief valve is being tested, the air will hiss as it leaks past the disk. A pop valve opens almost instantly with a loud pop. If the valve opens at the specified pressure, remove the cap from over the adjusting screw, and mark position of the latter with a scribe or center punch

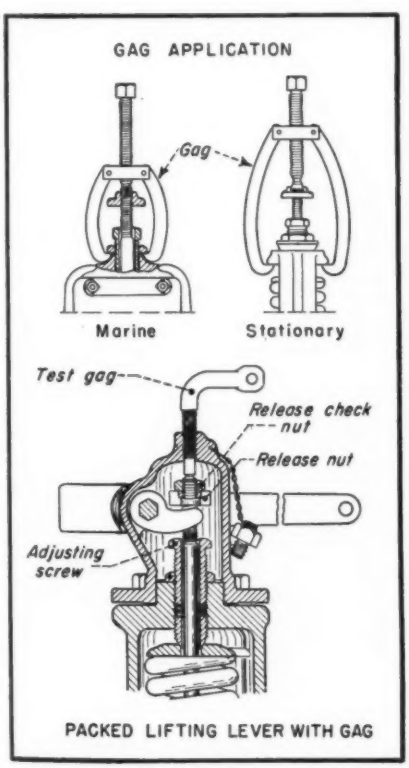


Fig. 5—Adjustable gag holds safety valve closed during hydrostatic test

LEAKTIGHT PRESSURE

Opening Pressure, psi	Leaktight Pressure, psi
0 to 10	Opening pressure minus 1
10 to 25	" " " 2
25 to 50	" " " 3
50 to 100	" " " 5
100 to 175	" " " 7
175 to 250	" " " 10
250 to 350	" " " 15
350 to 500	" " " 20
500 to 1000	" " " 25
1000 to 2000	" " " 35
2000 to 5000	" " " 100

to facilitate reassembly adjustment.

If operating temperatures are above 250 F, set the valve about 3% higher, and if above 1000 F set it 5% higher, than the desired pressure to compensate for the action at elevated temperature.

Then completely dismantle the valve and grind disk and seat, using a fine carborundum paste. When valve construction permits, grind seat and disk on a lapping plate rather than against each other. During dismantling, exercise care not to disturb the blowdown-ring setting on a pop valve. After grinding is completed, again wash all parts in the degreaser and reassemble the valve, using the above mentioned center-punch mark to indicate proper position of the adjusting screw. This saves much time that otherwise would be used in experimentally setting the valve to open at the desired pressure. Again place valve on test block and manipulate the adjusting screw until its setting is correct.

Release the pressure and again raise it slowly to a few psi below the set pressure; make a leak test. Test for leakage by dipping a long-bristled varnish brush of appropriate width into a bucket of thick soap solution; draw it slowly across the valve outlet so as to leave a film across the opening. If this bubble remains a few seconds it indicates a tight valve. Desirable leaktight pressures are given in the table.

If valve leaks, lift disk from its seat and wipe both surfaces to remove any adhering dirt particles. Continued leakage must be corrected by regrinding. When valve is leaktight at pressure indicated by the table, record the test date on the valve's case-history card.

Secure the cap over the adjusting screw with a wire and lead seal to prevent tampering and return the valve to its position on the apparatus. Have the operator witness this replacement, and be satisfied that he can safely raise the pressure in the vessel. If, as may happen in a rare instance, a blocking valve is located under the safety valve, seal it open in the presence of the operator.

Occasionally it may be necessary or desirable to change the operating pressure and, as mentioned above, this means changing the safety-valve setting. Most valve springs permit adjustment of about 10% either way. If the contemplated change in operating pressure exceeds this amount install a new spring. Of course, it is always safe to reduce the pressure, whereas the safety-valve body may not be able to withstand an increased pressure. Accordingly, give this fact serious consideration before changing to a heavier spring.

In changing the spring size, the chart, Fig. 4, is useful. As the diameter and over-all length of the spring are fixed by valve-body design, the change must be made in the diameter of the spring wire.

MARK PLAINLY

When changing the setting of a safety valve it is extremely important that the stamping, either on the nameplate or on the valve hex, be changed accordingly. This may require obliterating the old figures by filing or peening. But most important of all, when the valve is serviced for the first time, also before serious consideration is given to raising the set pressure, the engineer or a competent mechanic must make a check to assure that the pressure vessel and all connected piping will withstand the higher pressure. When making a hydrostatic test hold the safety valve on its seat with a suitable gag, Fig. 5.

Where the safety valve is subject to excessive corrosion or gumming from material in the system, it is good practice to install a suitable rupture disk (POWER, April 1946, p 74) in the pipe ahead of the valve, to keep the material from entering it. The rupture disk should be rated at or slightly below the valve set pressure. Should pressure in the system exceed this amount, the diaphragm bursts. This allows the material to enter the valve which then opens and relieves the pressure.

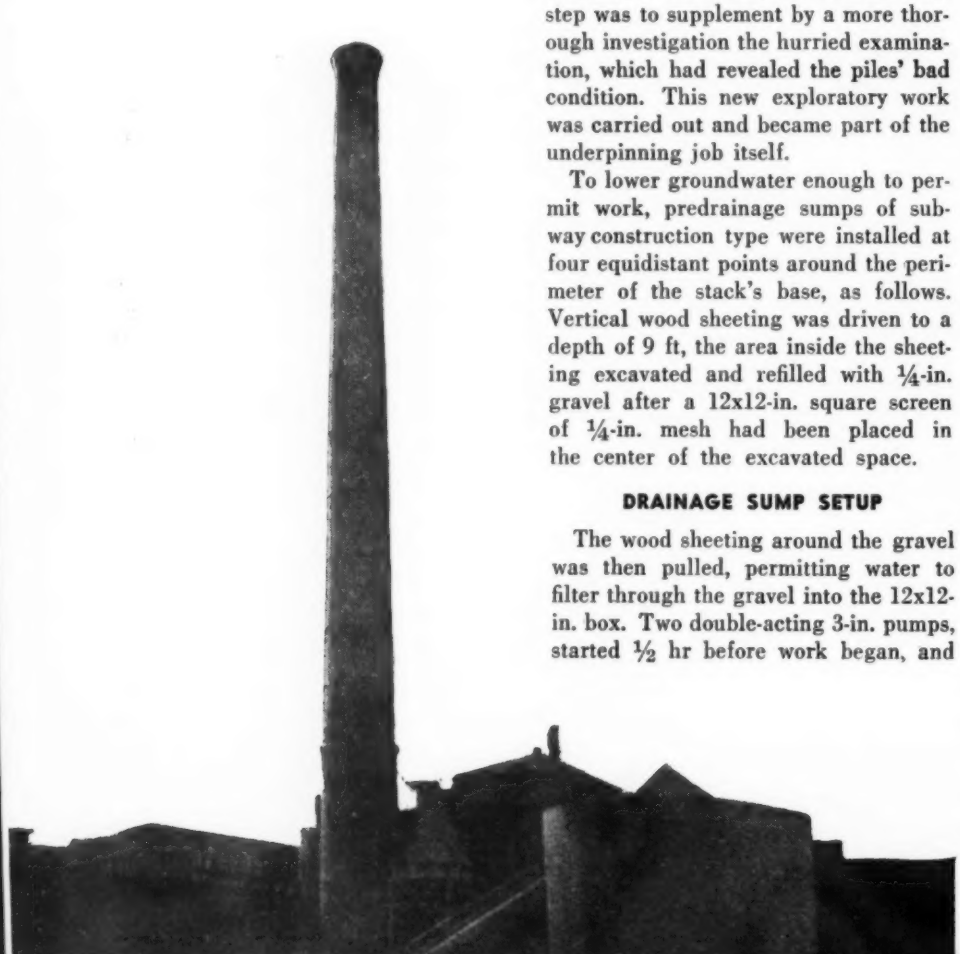
A safety valve is without question the most important device, yet it is perhaps the least costly of any that is used in connection with a pressure system. However, it may prove to be false security if a safety valve is not properly selected, installed and maintained. Loss of life and extensive damage to property may result if it fails to perform as expected.

Underpinning a 175-Ft Operating Smokestack

Albert Di Giacinto, senior engineer of Spencer, White and Prentis Inc, tells how the methods to underpin an operating brick smokestack succeeded despite a water-bearing sand base

► IN IMMINENT DANGER of collapse because its wood-pile foundation was rotting away, the 175-ft brick smokestack of United Cork Companies, Kearny, N. J., was recently underpinned successfully without taking it out of service. Investigation of the wood piles supporting the stack was prompted by discovery of rotted piles under a section of the adjacent powerhouse walls. Test pits excavated on two sides of the stack revealed that the wood piles were badly rotted in the 15-in. zone between groundwater level and the bottom of the chimney concrete base.

Cutoff Point. The wood piles were cut off above the groundwater level. It seems unlikely that this level dropped after the structure was built because the Passaic River, subject to ocean tides, is only 300 ft away. One idea advanced was that perhaps the designers relied on a once prevalent theory that spruce piles, by capillary action, could resist rotting when installed a short distance above groundwater level. If the piles were cut off above such level on this theory, conditions exposed by the test pits certainly disprove it. Most likely the piles were cut off above groundwater level by mistake when plant construction was rushed during the first World War.



In underpinning the stack, the objective was to provide new support as soon as possible with minimum disturbance to the feeble foundation. First step was to supplement by a more thorough investigation the hurried examination, which had revealed the piles' bad condition. This new exploratory work was carried out and became part of the underpinning job itself.

To lower groundwater enough to permit work, predrainage sumps of subway construction type were installed at four equidistant points around the perimeter of the stack's base, as follows. Vertical wood sheeting was driven to a depth of 9 ft, the area inside the sheeting excavated and refilled with ¼-in. gravel after a 12x12-in. square screen of ¼-in. mesh had been placed in the center of the excavated space.

DRAINAGE SUMP SETUP

The wood sheeting around the gravel was then pulled, permitting water to filter through the gravel into the 12x12-in. box. Two double-acting 3-in. pumps, started ½ hr before work began, and operated only during the 8-hr work day, removed this water, which drained through the 9-ft sand stratum overlying the peat. Fine gravel that surrounded the screen acted as a filter so only clear water at a velocity low enough not to carry any ground sand with it entered the pump suction. These predrainage sumps effectively lowered the water table so men could dig 4 ft below bottom of footing or about 2 ft, 9 in. below groundwater level in the dry. Had they attempted to excavate under the stack foundation without predraining the ground, the fine water-bearing sand would have run like water, causing loss of ground and consequent loss of lateral support for the feeble rotted-pile foundations, already dangerously weak.

LOADING FIXED PILING

As soon as sump No. 1 had been put in operation, an approach pit was excavated and sheeted with horizontal 2 in. plank to permit inspection of the piles at this point. As preliminary investigation indicated, all piles were rotted above water level to some extent. One exposed pile, cut off 33 in. below bottom of concrete footing, was perfectly sound at the cutoff elevation. In fact, it was sound just a few inches below groundwater level. The ground had settled away from bottom of stack footing leaving a space of about 4 in. As soon as the pile was cut off a steel I-beam strut, bearing against ¾-in. plates at top and bottom, was installed by driving steel wedges between plate and steel strut. This had the effect of loading the pile immediately, thus adding support to the foundation.

PILE CARRYING CAPACITY

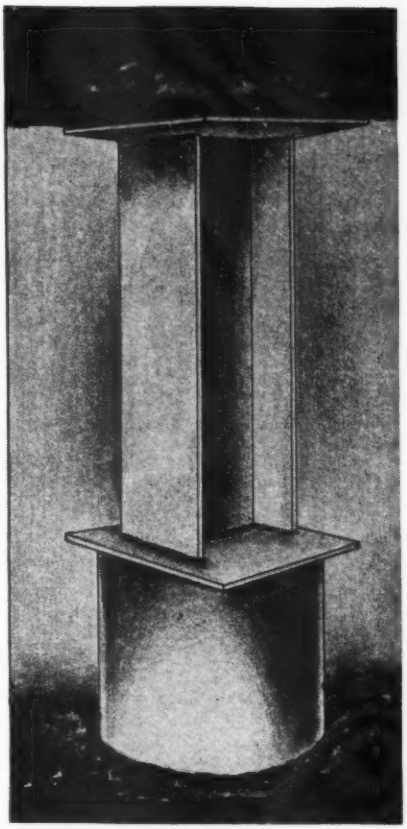
At this point the opposite side of the stack foundation was investigated. The exploratory pit here revealed that the piles were in bad condition. In fact, many were in an alarming state, being 100% rotted and offering no support at all to the stack. To supply some additional temporary support as soon as possible, wood piles that were accessible were cut off at any elevation that provided bearing, to permit installation of bottle jacks. Later these piles were cut off 33 in. below groundwater level. To determine the piles' carrying capacity as originally driven, one pile in pit No. 9 was cut off and a load test applied by a 4½-in.-dia hydraulic jack. At 25 tons top of pile settled ⅛ in., and at release of load rebounded to its original position. Three other piles picked at random in pits 1, 9 and 13 were treated with the same result, which

indicated that the piles had originally been driven to an excellent supporting strata.

Replacing Underpinning. It was, therefore, decided to (1) cut the wood piles off one at a time 18 in. below groundwater level (2) replace rotted section of piles with I-beams weighing 25.5 lb/ft, and (3) fill the space from 6 in. below the cutoff piles to the existing stack-foundation bottom with 3000 lb of concrete. It was poured to within 2 in. of the chimney foundation's bottom, and the space drypacked the next day with a moist mixture of sand and cement. A ¾-in. steel plate spanned the hole left by the pile butt in the foundation of the stack. A 12x12x¾-in. steel plate was also placed on top of the pile after it had been cut to grade.

The steel strut was cut a little shorter than the actual distance between the plates to permit inserting steel wedges. These were driven in tightly with an 8-lb sledge hammer to put load on the pile. Base of chimney was divided so the underpinning would be installed in 16 sections. Sections 1, 5, 9 and 14 were first installed, one at a time, to provide some new support on all sides of structure. Following this, two sections opposite each other were worked simultaneously to expedite the job.

Strutting Piles. Because of lack of access, a few pits were left open after the piles had been cut off and strutted until the adjacent pit had been completed. The two pits were then concreted in one pour. In all, 65 of the 81 piles under the stack were cut off and concreted. The 16 piles not cut off were at or near the stack center and were inclosed by the solid ring of concrete underpinning. It was felt that the estimated 800-ton weight of stack and foundation could safely be carried by the 65 piles cut off in view of the excellent bearing powers indicated for the piles by the load tests. Furthermore, piles in the outer rows were the most important because they carried almost all the load induced in the foundations by wind.



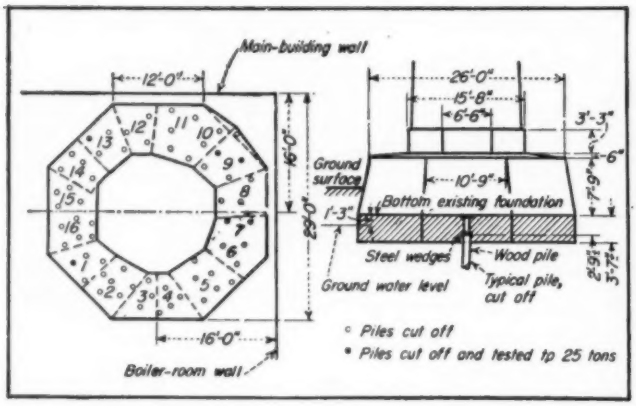
Cutoff top of a rotted piling with I-beam added between it and foundation. Plates on ends of I-beam serve to cover butt hole in foundation and to cap the cutoff pile. Wedges driven between the beam and plates load the pile

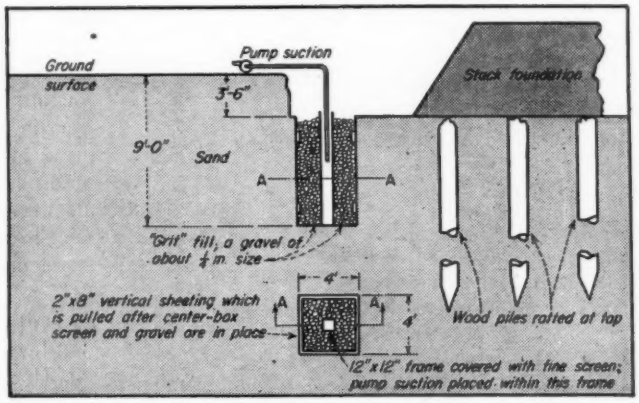
CHECK STACK MOVEMENT

A complete system to check both vertical and horizontal movement of stack, inaugurated when the job started, was continued until underpinning was completed. To check vertical movement, points were set on each of the eight corners of the stack's base. These were referenced back to a permanent bench mark and showed no movement throughout the underpinning process. Stack base was referenced to the existing building by horizontal measurements. No horizontal movement occurred. This record of no movement held despite full use of the stack.

For observing such movement of top of stack, which was about 3 in. out

Typical specimens of rotted sections of piling, some of which were so completely worn away as to give no support at all. By cutting off the piling just below the rotted section, the sound portion left made a good I-beam base





Left: Octagon-shaped concrete-filled pad with I-beam—topped pilings under the existing foundation. Replaced and tested pilings are indicated. Right: The sump device lowers groundwater to permit the underpinning work

of plumb, a point was established on the ground 225 ft north of the chimney. A transit was set up on this point and the line of sight brought tangent to right side of the stack's top. This point was then dropped to the ground by lowering the telescope of the transit, and a point was established about 10 ft in front of the stack. A similar control point was established west of it. These two control points being at right angles would have revealed any movement of the chimney top. Daily observations showed no change in stack location. Its deflection by wind was readily apparent but as soon as it subsided, the stack went back to its original position as described above.

SAFETY
In the Boilerhouse

Max H Kuhner, chief mechanical engineer, Riley Stoker Corp, outlines problems of developing and maintaining safety from designer, plant management and plant personnel standpoint

► IN BUILDING a workable boilerhouse safety program three equally important factors serve as the framework: boiler-equipment design, layout of building and auxiliaries, and alertness of personnel. These basic elements demand contributions from equipment manufacturer, plant management and personnel.

A manufacturer's role in meeting safety requirements involves (1) his reputation (2) rules and specifications of the *ASME Boiler Construction Code* (3) use of advanced manufacturing facilities available to a fabricator, such as fusion welding, X-ray analysis of welded seams, physical tests of parent and weld metal and stress relief of a completed vessel. Such precautions, aided by a vigilant check exercised by insurance companies and state inspectors, insure that a boiler is safe, at least against rupture under operation up to its design pressure. An evidence of this system's effectiveness is its record of no explosions of any modern power boiler anywhere in this country regardless of pressure.

Danger in Tubes. But design of a safe boiler goes beyond assurance of strength in pressure parts. For example, tubes in a boiler or waterwall system may become steam-bound under normal operation or with sudden changes in load, so these tubes form potential elements of danger. Tube rupture with an accompanying sudden discharge of steam or water into a furnace may produce a furnace explosion.

In one modern furnace the floor was screened by a row of bare tubes. This high-roofed unit, following a pronounced trend of a higher and higher furnace-setting to minimize, or eliminate entirely, slag or ash deposits, experienced no slag difficulties in its upper regions under normal loading when firing its specified fuel. Abnormal war times changed these optimum conditions of loading and fuel. Slag developed in the furnace and accumulated near the top, forming a clinker that was judged to weigh over half a ton. This mass of slag suddenly broke loose, crashed down on the tubes screening the floor, and tore several tubes from their headers. Two boiler operators were scalded to death and several others hospitalized many months.

PROPER SETTING HELPS

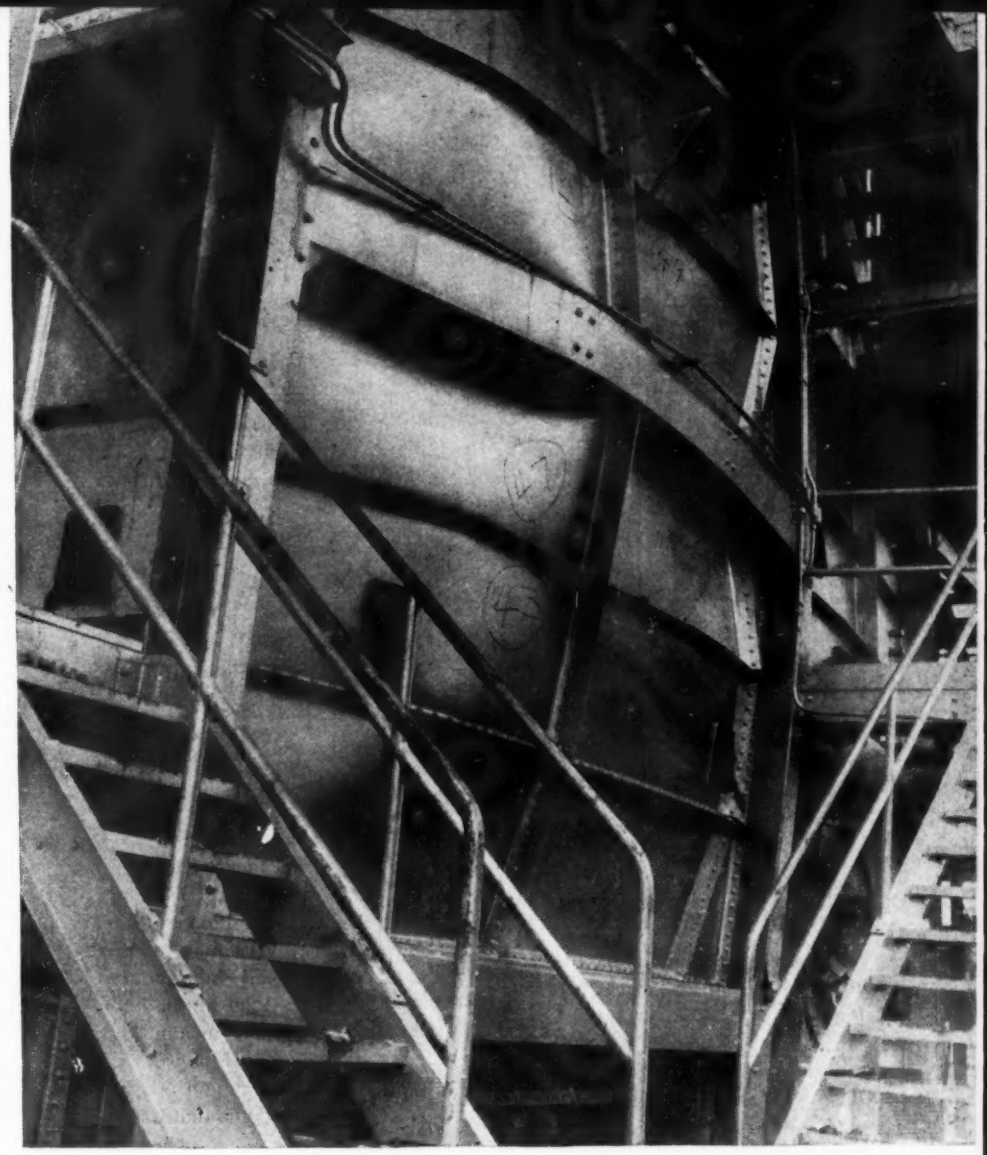
Some protection against such a calamity lies in the boiler setting. A steadily increasing acceptance of housing boilers in rugged steel casings gives reason-

able security from injury and sudden death from furnace puffs or minor gas explosions. Accompanying illustrations show a steel-cased boiler setting after a severe furnace explosion. Since setting design did not permit anchoring or supporting any part of it on tubes or other pressure parts, it was gratifying to find that hydrostatic tests, after the explosion, proved the pressure system completely tight.

These examples, with mention of design considerations beyond the boiler proper, are cited to impress a purchaser with the short-sightedness of selecting equipment from price alone. Supplementary features may enhance safety for a given installation far beyond its cost in dollars and cents.

EXTERNAL SAFETY AIDS

An additional class of safety provisions, boiler externals, falls jointly on the shoulders of management and manufacturer. These include safety valves to relieve excess pressure, water columns and gages to warn against high and low water, explosion doors to provide relief of high pressures in furnace and gas passages, and, often, automatic interlocks and warning devices. These last, if in good working order, make it impossible to start fuel supply to a furnace before proper draft conditions are established; automatically shut down forced-draft fans if fuel supply fails; and warn operators with sound or lights, or both, of unusual fuel, water or air conditions that could prove troublesome. Many of these safety aids serve also to prolong equipment's operating life.



Closeup of steel-cased setting shows the terrific force released in explosion. Reinforcing girders are bent but the setting itself shows no opening at all

PROTECTION OF LIFE

So much for devices protecting boiler equipment. Management carries the burden of adequately providing for the safety of its operating personnel. Most state and city ordinances list rules intended to safeguard the men. Government's interest in boiler installations include such precautions as (1) automatic locks to prevent furnace doors flying open under monentary high setting pressure (2) certain minimum clearance between boiler top and boiler-room ceiling to permit access to valves, etc (3) explosion doors located and shielded to prevent injury to anyone in the vicinity during a furnace puff (4) operating platforms with two means of exit to insure freedom of movement for personnel. State and insurance-company inspectors see that these rules are met before they give a clean bill of health to a setup. But management's responsibilities do not stop there.

A Clean Boiler Room. Most modern boiler rooms are no longer "dark and dirty holes." A dust- and air-tight boiler setting, sealed coal bunkers, dustproof systems for preparing and transporting fuel and ash all work to promote boiler-room cleanliness.

Light, well-ventilated working areas are of first importance to human safety and comfort. Management, by specifying a slightly larger building than is absolutely necessary to house equipment, permits platforms and stairs in place of catwalks so easy access to operating and maintenance points becomes a part of good plant layout. A color scheme with contrasting colors at points of low level fixes attention on close quarters and also exerts a beneficial psychological effect if combinations are bright and pleasing.

Here, inspectors of insurance companies and state bodies can be of great aid to operating personnel and management. To a visitor many sources of boiler-room danger, unnoticed by regular personnel, stand out in their more hazardous light. A diplomatic suggestion may prevent an accident.

IGNORANCE ALWAYS THREATENS

Now for personnel. Records of boiler-insurance companies show that operating ignorance causes more boiler accidents by far than any other single cause. A case from insurance files that cost $25,000 property damage illustrates the point in mind.

A large Eastern manufacturer operated a 350,000-lb-per-hr slag-tap steam generator for power and process steam. Pulverizers, forced- and induced-draft fans were motor driven. One morning under full load, a main-turbine tripped, interrupting power supply to pulverizer and fan motors. As soon as the operator noticed the pressure drop and saw that his coal burners were extinguished,

he turned on oil to his standby atomizing oil burners. He forgot, however, to supply atomizing steam and thus solid streams of oil sprayed over the pool of liquid ash on the furnace floor. The oil vaporized before igniting. In the operator's efforts to keep up steam he had failed to check his fans and hence did not know that they had stopped running. In spite of a severe explosion that followed, damage was confined to this one boiler because its steel-incased setting held, protecting plant and personnel.

PRIDE AS A TOOL

To combat an accident attributable to such misaction requires an alert and knowing personnel. Where those in charge take personal pride in a boilerhouse, it is invariably both efficient and safe. If all personnel are instilled with pride in the individual job it means that every one is striving to get the best out of equipment. This pride comes from two sources: (1) example of older experienced men and (2) a program that acquaints an operating crew with practical and theoretical problems in operation—a system to promote thought.

Many prominent central-station organizations maintain an educational program for operating personnel. Periodic meetings discuss plant problems and occasionally present manufacturers' representatives to explain design and construction details. Charts and log books that illustrate changes in power output, steam and fuel balances, and resultant plant efficiency form a means of tying a man's job to over-all plant operation.

Small steam plants cannot conduct such a program on a practical basis. But this can be done: Establish close cooperation between chief and men. This proves most effective if a chief openly discusses records such as steam-flow air-flow meter charts, steam distribution and fuel consumption with his crew. Confidence is developed and ignorance combatted by a further coverage of the effect certain conditions have on a furnace; for example, boiler efficiency, steam temperature and, above all, conditions that may become dangerous if they are not checked.

Additional Education. As a supplement to on-the-job training stands a wealth of material in written form. With their equipment, manufacturers supply maintenance and instruction manuals, which contain valuable information, usually based on long years of experience. A chief who locks up this material for safekeeping defeats its purpose. It should be available to every member of a power-plant crew. In fact, extra sets could serve as good introductory material to each new plant employee. Technical magazines broaden an operator's understanding by acquainting him with his field. Engineering groups such as the NAPE provide discussion with fellow operators and are further sources of education.

INDIVIDUAL'S ROLE

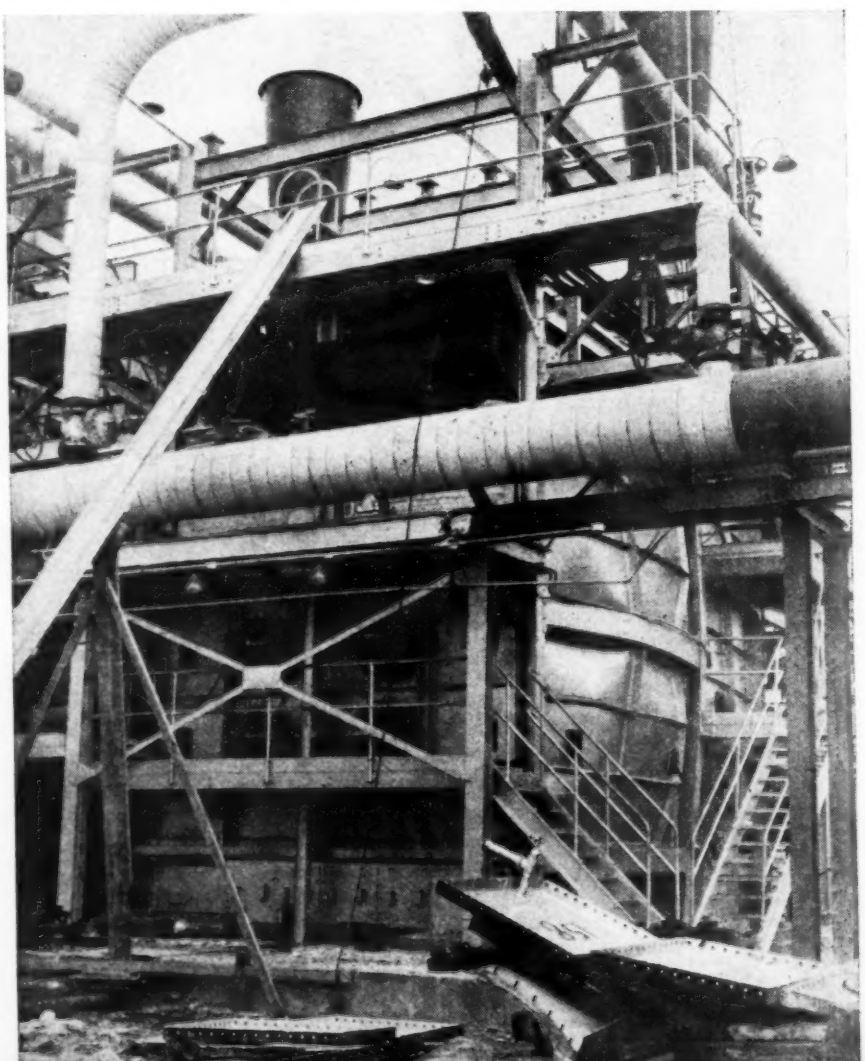
Opportunities for acquiring knowledge that makes an operator's job easier and safer are readily available but whether advantage is taken of these opportunities depends upon the individual. He must be made to realize that his job is of vital importance. Operation and care of equipment representing a large capital outlay depend for an efficient and safe life upon his personal performance. In his hands he holds the safety of an entire plant and its personnel. Such an important job must be filled by alert, responsible, physically fit men, able to exercise common sense in an emergency.

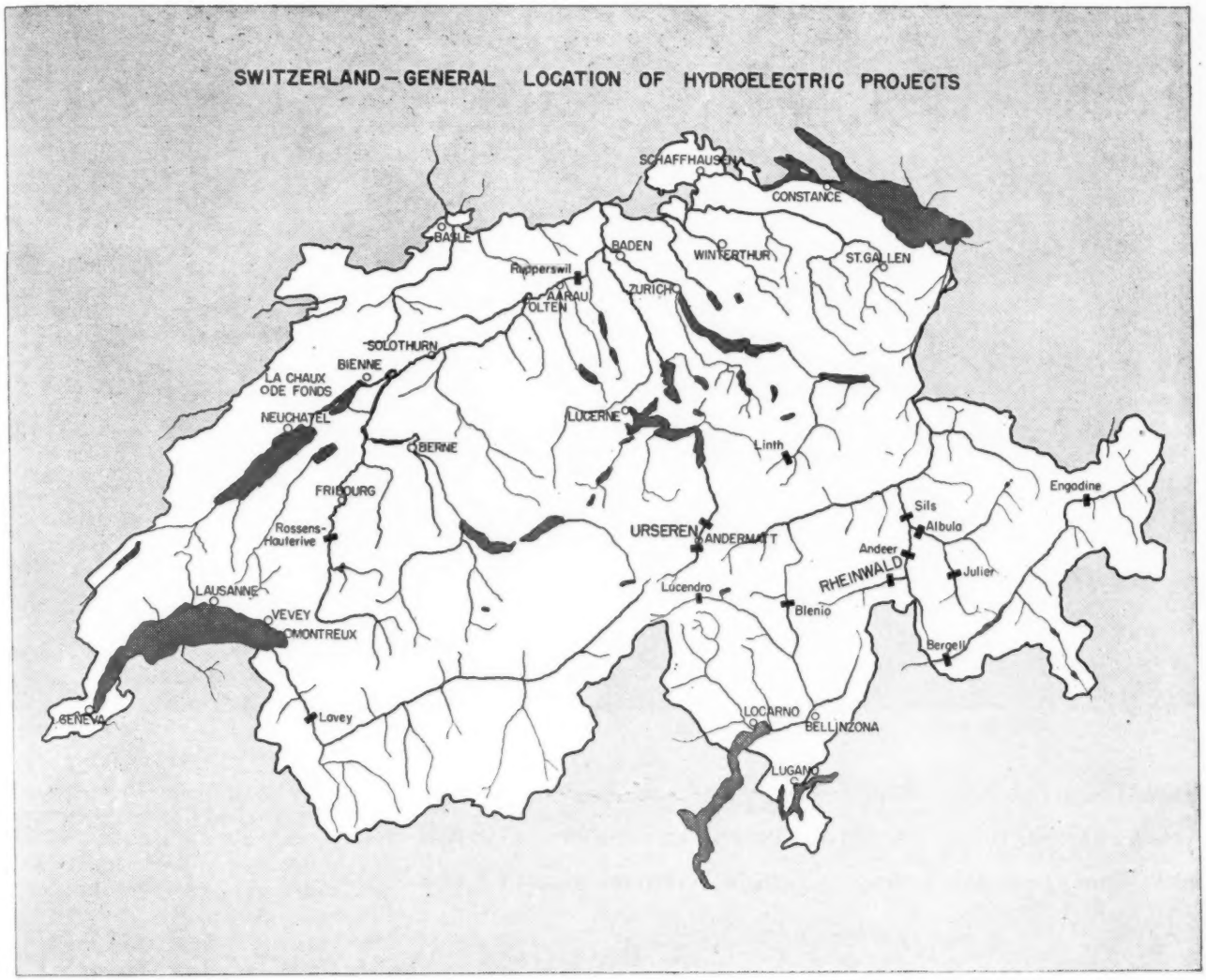
In short, safety in a boilerhouse depends upon equipment (1) properly built (2) adequately designed for a plant large and bright enough for safety devices and operating room and (3) efficiently operated by alert, responsible personnel. This combination provides the only solution to safety problems.

Summing up the problem of producing and maintaining safety in the boilerhouse: Equipment design, careful thought and planning in building and auxiliary layout, in addition to personnel alertness, combine to form a framework. Each factor bears importance in prevention of danger to men and equipment.

Training and experience of boilerhouse personnel play a large part in plant safety but the most resourceful crew is helpless if a boiler contains dangerous design features and has inadequate safety auxiliaries. These last provisions are management responsibility. No alert management feels that its safety obligations are discharged by tacking up *Safety First* signs. It must provide the means by which safe practices are set up, and made workable.

Front view shows gas burners of natural-gas-fired furnace after an explosion. Casing panels in foreground were removed after the accident for straightening





Switzerland Plans Power Expansion

► ZURICH (*McGraw-Hill World News*): Faced with a war-born power shortage caused by industrial expansion and fuel scarcity, Switzerland is mapping large-scale exploitation of untapped hydroelectric resources, which have been estimated conservatively at 21 billion kwhr annually. Design of new plants aims especially at reducing the winter power dropoff.

New projects and additions begun or put into operation last year will supply a substantial kwhr increase but this seems negligible in comparison with huge projects now in the planning stage.

New Plants. Included (see map) are: (1) the pumped-storage Lucendro project (Aare-Tessin A. G.) still under construction but in partial operation with installed capacity is 46,000 kw (2) the Rupperswil plant on the Aare River, also of 46,000-kw capacity, with a potential of 210,000 kwhr annually (3) the Albula plant (supplying Zurich) where a capacity increase last year from 18,000 to 22,000 kw makes available another 35,000,000 kwhr annually.

Under Construction. The Rossens-Hauterive and Julier plants—both scheduled, before a shortage of concrete slowed work, for completion next year—are still under construction. The former, with a capacity of 56,000 kw, will replace old equipment, capable of producing 50,000,000 kwhr annually, with new machinery capable of producing 200,000,000 kwhr, of which about 40% will be available during winter months. The 25,000-kw Julier plant will add 140,000,000 kwhr annually to the Zurich supply. One third of this will be available in winter.

Several smaller plants, which will add another 20,000,000 to 30,000,000 annual kwhr, are also under construction at various points. Also on the way is the Lavey project on the Rhone River at Wallis, involving replacement of the old Bois Noir (1902) installation, which had a maximum capacity of 9400 kw and an annual output of 76,000,000 kwhr. New machines will produce 308,000,000 kwhr annually.

Huge Projects Studied. Mapped to meet the winter dropoff problem are many huge projects still on the drawing boards. Locations on the Upper

(*Continued on page* 152)

POWER AT BIKINI

Back from Bikini, Editor Swain exposes atomic-bomb nonsense, and tells power men things an engineer more concerned with significant facts than sensational fancies should know

By PHILIP W. SWAIN, *Editor of* POWER

I WENT TO BIKINI to report the two atom-bomb tests for all the McGraw-Hill publications. That job is finished, so I'm back again on the POWER reservation to tell my own readers, as one inquiring engineer to another, what I think the "shooting" was all about.

This won't be a "play by play" account of a cosmic drama, or anything of that sort. Public understanding of the atomic-bomb experiments gains little from treating them as sporting events.

As I lived for weeks on the press ship, *Appalachian*, in an atmosphere tense with real and imaginary news stories, I came to fear that "Crossroads" would be the most widely misunderstood scientific experiment in all history. Today it *is* that.

Hoping that power men, trained to think in terms of numbers and energy, and cause and effect, may help clear up atomic-bomb thinking in their own communities, I'm going to set down my thoughts and observations, stressing the things that are really important.

My first job is to nail down a number of false notions — some peddled before the bomb tests, some after. Here are some pre-bomb fallacies:

1. *The bomb will cause big earthquakes and tidal waves.* No real scientist made any such prediction. Remember that a big earthquake has the energy of hundreds, even thousands, of bombs.

2. *The bomb's temperature of hundreds of millions of degrees will melt the steel of ships.* No more than the sun's surface temperature will melt a tin roof exposed to sunshine. The hundred-million-degree temperature is confined to the bomb's center and to millionths of a second. Its effect on ships is a flash "sunburn" — surface paint blistered but undercoat unburned even within a half mile of the air burst.

3. *Pressures are thousands (or millions or billions) of pounds per square inch.* Pressure where? The pressure is almost anything you may name according to distance, but certainly air-blast pressure half a mile from the bomb is no more than a few psi.

4. *Hundred-foot-high waves will sweep everything off Bikini Island.* Oceanographers predicted and obtained 90-ft waves 1000 ft from the blast. Also, as predicted, the wave height varied inversely as distance. At Bikini Island, over 15,000 ft away, the height was well under 10 ft. At the far end of the lagoon (over 20 miles) the waves were less than one foot high — also as expected.

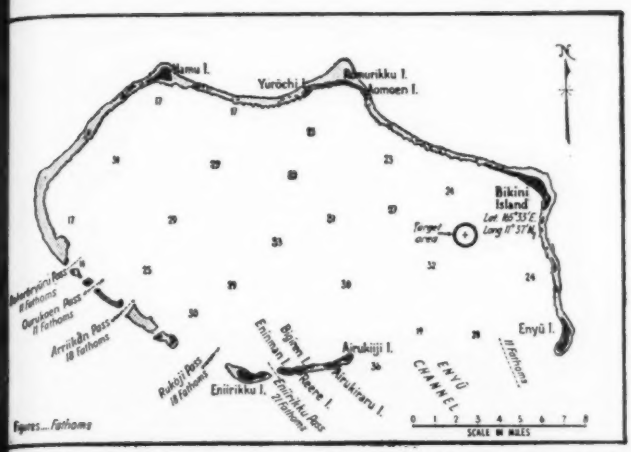
5. *Great winds will blow down the trees on Bikini Island.* Again, as predicted by those who understand explosives (atomic and otherwise), the super-hurricanes close to the bomb dwindled rapidly with expanding radius so that not a single palm leaf was torn on Bikini Island.

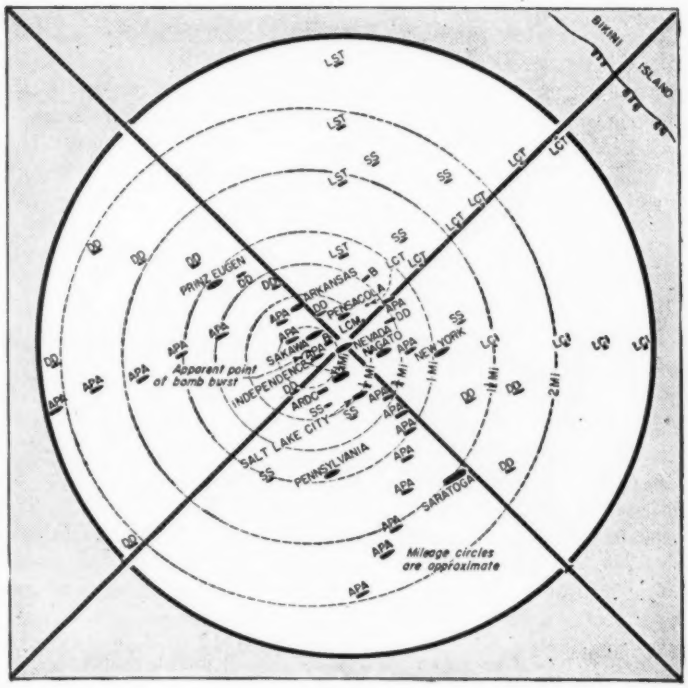
6. *The fission products will poison the whole Pacific.* There's a lot of water in the Pacific. See your globe.

Much of this unscientific nonsense stems from failure to understand that all effects fall off rapidly with distance from a body that radiates energy in all directions. For example, light intensity varies inversely as the square of the distance from its source. At ten times the distance intensity drops 99%, whether it is sun light, lamp light, or an atom-bomb flash.

Air blast, underwater blast, sound, surface waves — all these bomb effects — fall off rapidly with distance. There isn't anything about an atom bomb, or any other, that distance won't cure.

This may seem obvious to engineers, but it is certainly not understood by the American public, many of whom im-





Above: Bikini lagoon simulates a shallow harbor; it is surrounded by coral reefs from which rise some islands. *Right:* Target array for air-burst (Able) test has ships arranged to produce graded damage. Dashed circles show approximate mileage from estimated blast point. Ship designations are: DD, destroyer; SS, submarine; APA, attack transport; LCI, landing craft, infantry; LCT, landing craft, tank; LST, landing ship, tank; LCM, landing craft, mechanized; ARDC, floating drydock; B, barge

agined that the immense temperatures and pressures at the bomb center would somehow become active over the whole area of destruction.

In debunking exaggerated notions of distant atomic-bomb effects I sincerely hope that I don't seem to agree with Aviator Seversky, who belittled the atom bombs' destruction at Hiroshima and Nagasaki. In my opinion those bombs were as bad as reported.

After noting the "small" number of ships sunk in Bikini tests Able and Baker, the public, and some observers, felt a letdown. The bomb "wasn't as powerful" as they had expected. Their basic mistake was in counting the *number* of ships sunk as a measure of bomb effectiveness. By itself this number means exactly nothing, just as the number of houses and people destroyed by an atomic bomb burst over land means nothing unless you know the lay-out of the district.

You will get only a small fraction of the Hiroshima death and destruction if you burst the bomb over Iowa farms where houses and people are spread out thin. This should be obvious, but how many citizens have noticed that the target arrays at Bikini were mostly open water averaging scores of acres of water for every ship, or that the area in the Baker target array marked "bomb will be detonated in this space" was a completely empty patch of water about a mile long and about three-quarters mile wide? Bombing water won't sink ships unless they happen to lie on the water within the circle of potential destruction.

From my observations at Bikini I am convinced that either an air burst or an underwater bomb could easily sink from 20 to 40 large warships if they were tied closely together, directly over or under the atomic bomb. To put it another way, I figure that an air burst will sink all the ships you can squeeze into a circle well over a quarter mile in diameter. For a shallow underwater burst, the diameter of this circle of sure sinking would be well over half a mile.

But please don't conclude from the wide spacing of the inner ships in test Baker that the Navy "stacked the cards" to make a showing of few ships sunk. One ship of each type sunk is enough for curve-plotting purposes. Following the President's instructions, Admiral Blandy so disposed the target ships as to get "graded damage," ranging all the way from sinking to nothing. Each kind of ship, at each distance between sinking and no damage, gives a curve point.

Air burst produced this huge radioactive cloud, shown rising from the waters of Bikini lagoon. The tremendous pressure and temperature at the explosion center diminished rapidly as distance increased

The undramatic truth is that the Bikini tests were conducted *primarily* to get points on a set of curves, and that the intelligent use of these curves by the men who build and operate the Navy will be worth many times the estimated $70,000,000 cost.

If we can't get along without a Navy — and no one has yet shown how we can — that Navy must be designed to meet the actual conditions of an atomic age. More about that later.

Both Bikini tests were brilliantly planned and managed. True, the first bomb embarrassingly missed the target ship, *Nevada*, by 1500 to 2000 ft. (astern, slightly to port). This will not greatly hamper the primary curve-plotting operation, based on the measured distance of ships from the actual burst. The burst elevation of, say, 400 to 600 ft, seems suitable. Statements, such as the bomb burst "three seconds too soon," are pure nonsense. I was able to estimate approximate vertical and horizontal positions of the air burst from sharp flash-shadow lines on the ships.

Underwater-test Baker sank the *Arkansas* instantly and the *Saratoga* later, which suggests that the blast was somewhere between the two, but closer to the *Arkansas*. This also checks with the fact that the *Nagato*, beyond the *Arkansas*, eventually sank.

As to depth of test-burst Baker, we know only that it could not have been more than the 180-ft depth of the lagoon. Perhaps somewhere between 50 and 100 ft down might be a good guess since this would correspond to submergence possible in many harbors.

The bomb tests were designed to find out what happens, at various distances, to the ship as a whole, to its parts, its power plant, its equipment, its ammunition, supplies, and to its crew—also, how pressure, blast, flash, radiation and other basic physical effects vary with distance. I don't expect that Joint Task Force No. 1 will reveal its many instrument readings. However, we were allowed to view target ships before and after to inspect ship damage and to estimate distances.

EFFECT OF AIR BLAST

The following is my summary of the effect of an air blast on today's typical warships: Up to one eighth mile, sinking; to quarter mile, heavy damage (topsides and underwater hull); to half mile, moderate damage (mainly topsides); to three-quarters mile, slight damage (topsides only); to one mile, trivial damage (topsides only).

Flash scorching of exposed paint is noticeable up to a mile, but this effect is only skin deep except very close to the burst. As close as a half mile the undercoat of paint is still unaffected. At this distance it seems possible that a crew can be protected from flash burns by masking face and hands. I am not so clear about the blast effect on men this close, but I now incline to the opinion that many men would survive the blast force as close as a half mile. *This statement does not apply to the effect of radioactivity.*

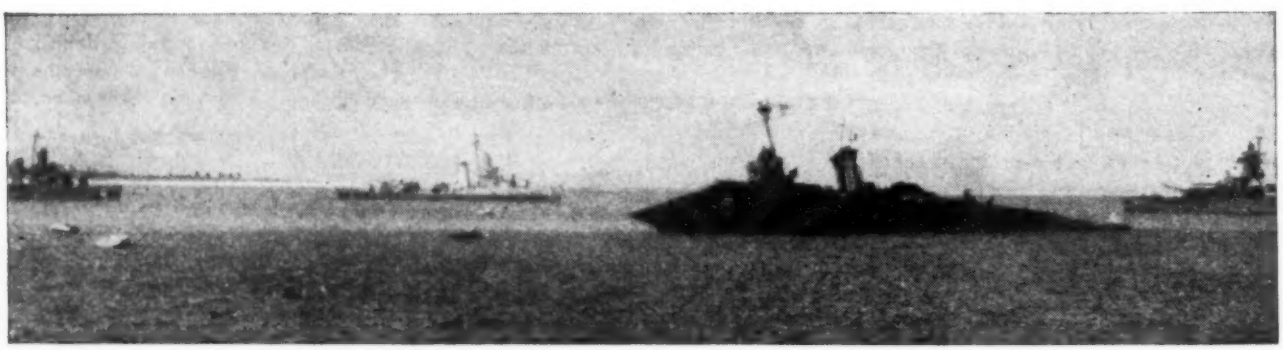
My most important observation after test Baker is that a single underwater atom bomb, exploded at a depth possible in a harbor, sank both the *Arkansas* and the *Saratoga*. These ships were at least 3000 ft apart, possibly 4000 ft, so we know for certain that an underwater atom-bomb blast can sink a ship 1500 ft away, and probably 2000 ft or more.

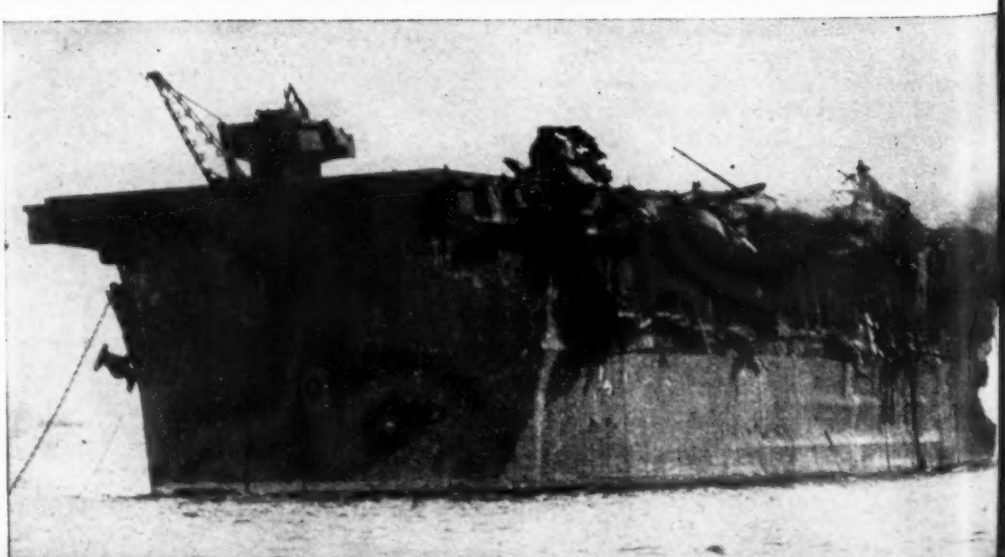
Once well beyond the sinking radius, the target ships in test Baker showed little damage I could see, either from a passing ship or from a low-flying airplane. Some day the Navy will know how far from the burst underwater hulls are badly bent and equipment damaged.

The maximum radius of physical damage seems greater for the air blast, although actual damage beyond a half mile is no more than moderate.

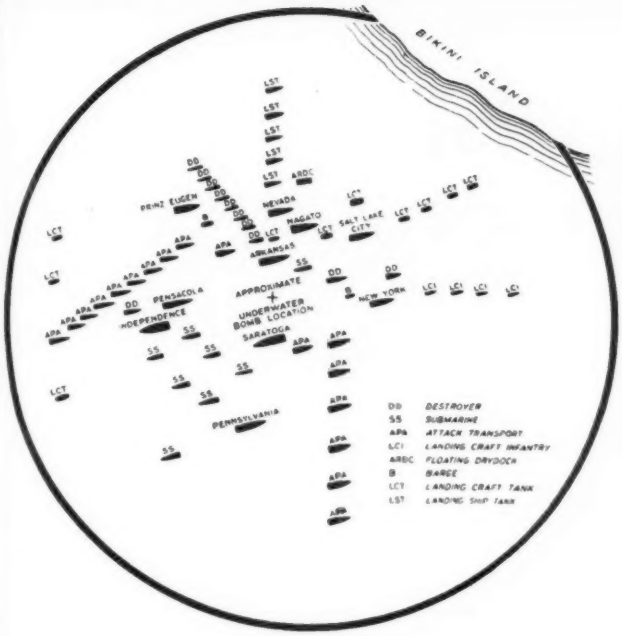
The general conclusion is that in a tight target array, an underwater burst will sink more ships than an air burst, but an air burst will damage more ships.

One may ask why these rules of thumb don't specify *kinds* of ships. Except submarines, the kind of ship has less effect on sinking or damage radius than you might expect, for the simple reason that all bomb effects increase very rapidly as you get closer. Thus, greatly strengthening a ship (say, changing from destroyer construction to battleship con-





Post-blast scenes like these impressed Swain and his fellow observers at Bikini with difference in damage resulting from the two explosions. *Above:* Famous *Saratoga* and a battleship roughly 4000 ft away were sunk by single underwater bomb, which spread radioactive death over a much wider radius. *Right:* Superstructure of aircraft carrier *Independence* was severely damaged by the overhead atomic blast



Target array for underwater (Baker) explosion differed somewhat from Able test but was planned to produce graded damage. Blast sank both *Saratoga* and *Arkansas;* complete damage report is lacking because danger from radioactivity proved much greater in this test. Photo on the cover was shot by automatic camera on section of beach at the upper right of diagram

struction) might not permit a ship to survive very much closer to the bombs.

This fact may greatly influence the design and operation of warships. The bomb tests reveal certain obvious weaknesses that can easily be corrected—frail stacks, masts and light-metal work on deck. But the admirals may well decide that there isn't much percentage in strengthening ships greatly to "withstand" atomic bombs. More ships, smaller ships and dispersal may be sounder protection. Just don't let any big fraction of your naval strength get close.

From the practical naval angle the whole picture is greatly complicated by radioactivity. It may happen that radioactivity will instantly or slowly kill the crew of a ship, even though both ship and crew survive blast and flash. Here I can't give you any precise figures: "Crossroads" isn't telling which animals on which ships died, and when. I do know that Admiral Blandy, and the rest of us, are greatly impressed with the effectiveness of atom-bomb radioactive poisons, notably in underwater blasts.

Here is the general picture: The bomb strength is officially stated as equal to 20,000 tons of TNT or more. This means that of the two to 200 pounds (official) of plutonium in the bomb, two pounds or more actually explodes (fissions), producing two pounds or more of medium-weight atoms, mostly dangerous radioactive isotopes of common elements.

In the air burst most of these fission products drift away with the cloud. What they do to crews depends on wind velocity and direction as well as on distance from burst. The air burst also bombards near-by crews with powerful gamma rays (like X-rays) and neutrons for a fraction of a second. Their effectiveness depends mainly on distance. Finally, this bombardment induces radioactivity in the water and on the ship—mainly in such sodium-bearing substances as common salt (in ocean, food, soap, etc).

Crews close in may be quickly killed by radiation even though below decks and behind thick steel. Others farther away may finish the battle in apparent good health only to die later from the cumulative effects of radiation.

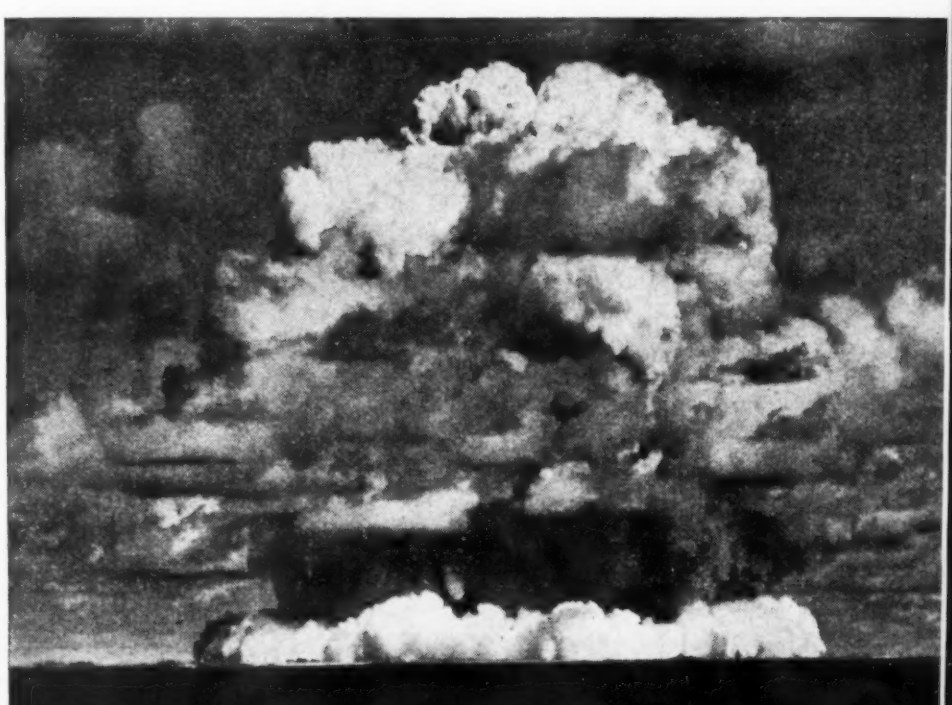
Injury from the direct radiation is much less with the underwater blast because of the water shield, yet the *over-all* radiation hazard is much greater from an underwater bomb. Fission products are caught in the water, thrown up in the sky, and dropped down again to poison the ships and the ocean around them. The concentrated mischief in this stuff is incredible. From a total of two pounds, plus, of fission products, probably less than one ounce was left sticking on deck and topsides of the *Nagato* after her atomic shower bath. Yet three days later a man who spent a day on her decks would have received 1000 times the safe dosage of radioactivity.

Without precise figures I estimate that both ships and the water in which they float will be intolerably dangerous over several square miles for several days after an underwater burst. Thus, for the underwater burst, radioactivity, rather than mechanical damage, may fix the minimum radius of ship survival.

I think the admirals realize that deciding what to do about radioactivity is perhaps the biggest single technical problem posed by the atomic bomb.

WHAT THE BOMB TESTS MEAN

In conclusion let me list several points: (1) The best target for an atomic bomb is a densely populated industrial region or city; the potential damage circle is solidly full of targets. (2) Yet, the atom bomb is the most effective weapon against ships ever produced, by far—one ship sure per bomb, and more as ships get closer. (3) A big ship will be well worth an atomic bombs. (4) It will take many atomic bombs to destroy a large fleet widely dispersed. (5) Best protection against atomic bombs is to keep your distance. (6) Best of all is to keep the other fellow from shooting them at you or even having any to shoot. "Shooting" implies that they can be delivered over long distance by rocket. They can.



Diameter of water column sent up by the underwater blast was measured as 2150 ft; waves hidden in the spray blanket were estimated as 60 ft high at radius of 2000 ft, and 90 ft high at 1000 ft. This photo was made after the one on the cover, which shows the water column at about its highest point

Photo (right) by Press Association, Inc.; others by Joint Army-Navy Task Force No. 1

What Will the Postwar European POWER PLANTS Be Like?

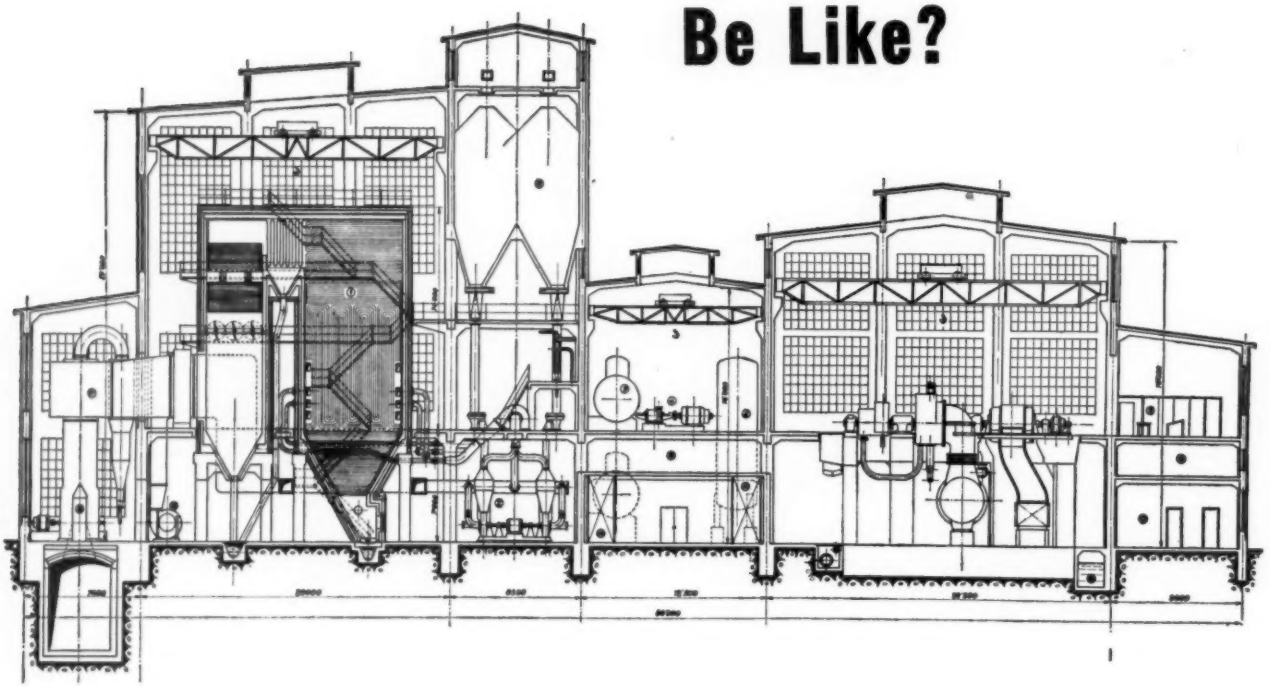


Fig. 1—Proposed new steam generating station engineered entirely by Sulzer Bros, employing four monotube boilers rated 275,000 lb per hr each and 1140 psi, 930 F, to serve four 24,000-kw steam turbine-generators

First-hand survey of Continental boiler and turbine builders indicates that only the Swiss are ready with coordinated designs for high temperatures and pressures. Look for high-efficiency tailor-made plants with a high proportion of forced-circulation steam generators, fully automatic control, reheat in some instances, careful attention to the ever present problem of burning Europe's poorest grade fuels

By S A TUCKER
McGraw-Hill World News

▶ IN COMPARISON with the program for new power facilities of the U. S. (POWER, Jan 1946) there is little actual new construction in progress on the Continent of Europe as yet. Repair and renovation of plants and transmission lines within the occupied zones under military government have successfully restored supply to many areas. Hamburg, for example, has about 90% of prewar capacity available for operation and the remainder of Germany is yet hardly able to use more electricity than has been made ready.

The Belgians have already ordered equipment from Switzerland; Holland is actively negotiating with British firms for reconstruction and equipment; France has some large turbines on order in the U. S., and other signs of definite planning are beginning to appear. However, unsettled currency exchange and lack of manufacturing capacity combine to retard the rate at which new construction can be undertaken.

Before the war the Continent obtained most of its steam-power equipment from the Germans and Swiss, with, however, a considerable amount of local manufacturing in France, Czechoslovakia and Italy, and some imports from Britain and Sweden. Now, in the early days of reconstruction, the Swiss alone are ready with up-to-date designs and shops-in-being to build them. Most of the first postwar generation of new turbines and boilers will wear Brown Boveri and Sulzer nameplates respectively.

For this reason, no comprehensive survey of trends in Continental plant design comparing the best features of several manufacturers can yet be undertaken. On the other hand, in preparation for just this contingency Sulzer Bros, of Winterthur, has set up an engineering department charged with the layout of complete power installations to include boilers of their own manufacture but turbines and auxiliaries built by others. A survey of certain typical existing plants and a review of others in the design stage affords an interesting indication of the type of European construction to be undertaken in the next few years.

Standardization of major equipment, such as has been well started in the U. S., is almost out of the question in Europe where high fuel costs require top-notch efficiency and where the tradition of many years standing associates power installations with industrial operations requiring exhaust steam or some form of heat. Conversely, wide variety in heat balance and equipment design is to be expected. Fuels and water supply vary greatly. Economic balance between investment and operating costs also depends greatly on the financial resources available to the purchaser.

Swiss industry is well accustomed to the philosophy of "tailor-made" power machinery since their prewar business has been largely for export to many nations having widely varied requirements. Also, in Switzerland, war needs have not siphoned away engineering talent from machinery builders. Thus new plants can be expected to be engineered to the last decimal point and to set a high performance standard.

Power-Plant Designs. A typical design now being engineered for a pulverized-coal-fired central station is shown in Fig. 1*. For a total output of about 100,000 kw, four condensing turbines have their associated condensers placed at right angles to the turbine axes with a single double-inlet motor-driven circulating pump for each. Four forced-circulation boilers, of 275,000-lb-per-hr capacity each, operate at 1140 psi, 930 F, under full-automatic control. Monotube boilers of this type can now be built for any pressure and for temperatures up to 1100 F.

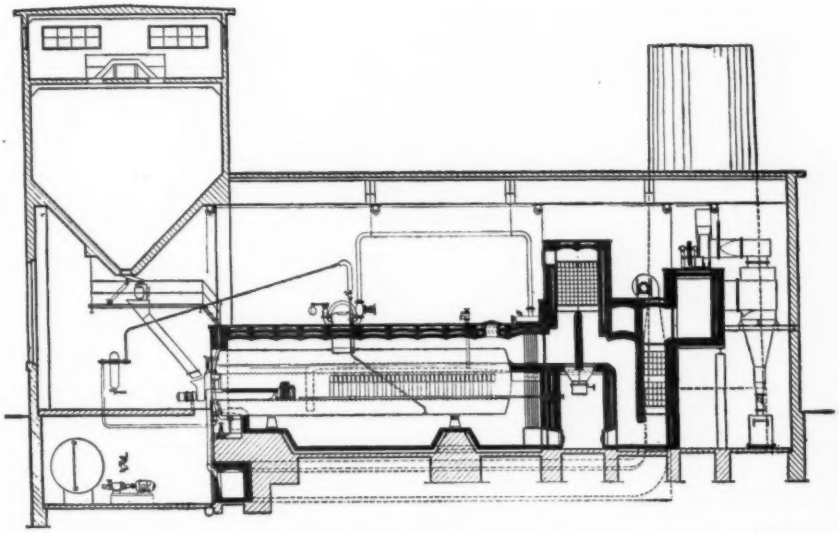


Fig. 2—For smaller industrial needs this firetube boiler produces 11,000 lb per hr at 255 psi, 570 F, using underfeed stoker, economizer and air preheater

In this instance, local water conditions require a water-treatment plant and considerable condensate storage. Two of the four boiler-feed pumps are steam-driven and two electric-motor driven. Coal bunker, pulverizers and all associated auxiliaries are grouped in a separate aisle between boiler and turbine rooms. Fans and dust separators are grouped at the rear of the boilers and the flue gas is led through an underground duct to a single stack.

As part of the job of complete-plant engineering, scale models, such as Fig. 3, are constructed by Sulzer as a final check on working spaces and piping layout. The model shown is for an industrial plant with six monotube boilers and two backpressure turbines.

Industrial Plants. It must not be thought that all Europe's new plants will be high-pressure high-temperature central stations. War experiences have tended to confirm the tradition of industrial power facilities directly connected with a specific industry and designed to furnish steam as well as electricity. In these, because of relatively high fuel cost and insecurity of a single supply source, careful attention must be given to fuel-burning equipment. Also, extension to existing plants is often limited in fuel-handling space and facilities.

* For additional details of steam-generation equipment shown in this article see *Sulzer Technical Review*, 1946, No. 2

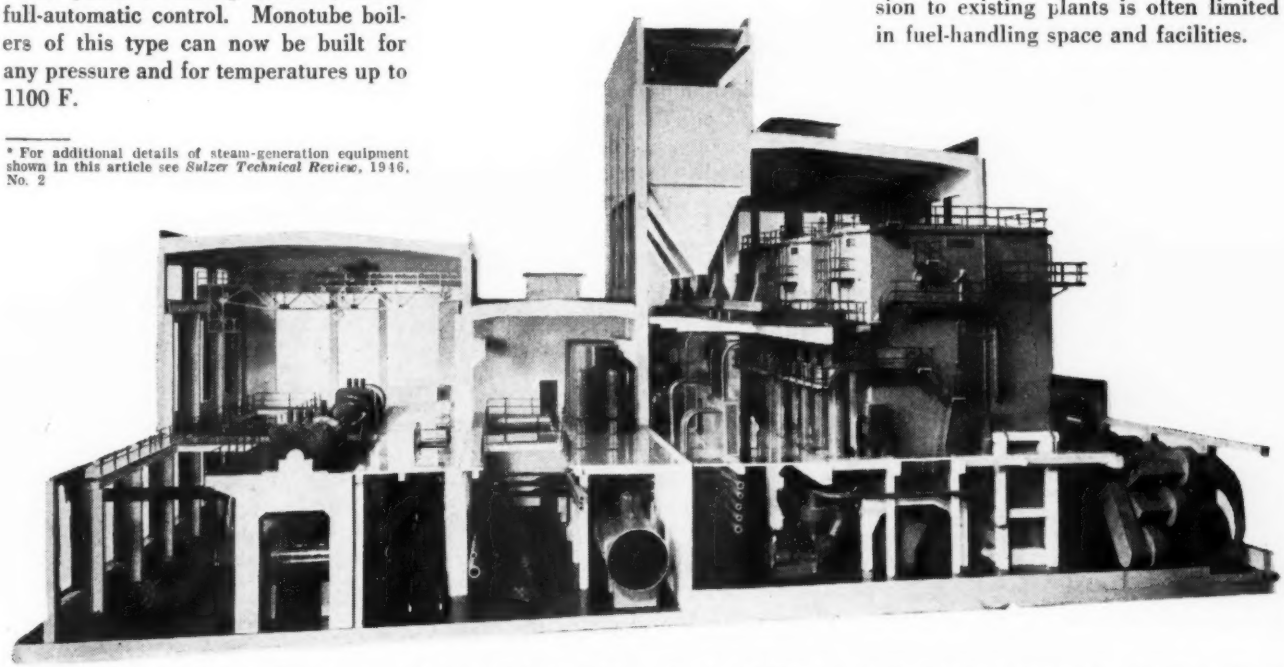


Fig. 3—Model of part of a large industrial plant with six monotube steam generators rated at 110,000 lb per hr each and 1140 psi, 930 F. Extraction turbines' capacity is 19,000 kw each. Model illustrates type of work Sulzer Bros is doing in systematic planning of piping system, regulating and safety devices and plant layout

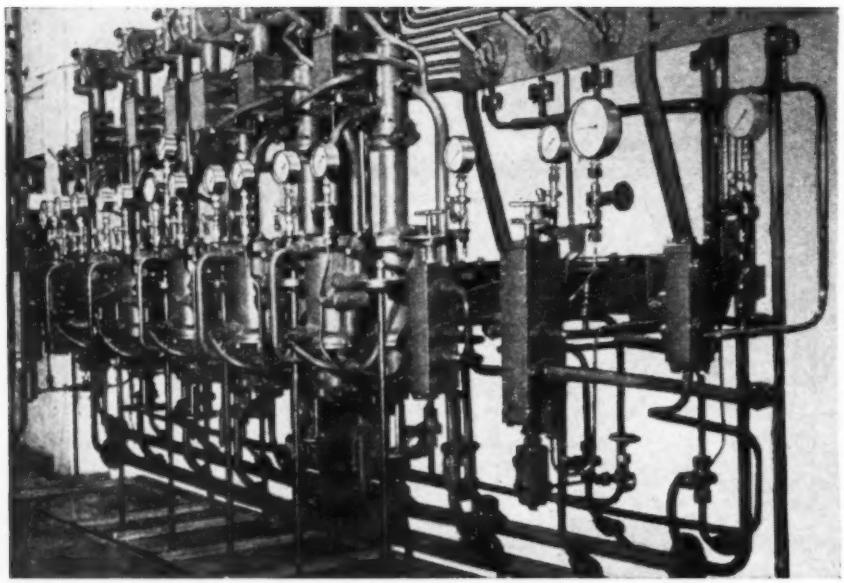


Fig. 4—Temperature-regulating equipment required for monotube boiler operating at 2000 psi, 930 F, with flue-gas reheat to 900 F, all automatic control

For example, Fig. 2 shows a typical modern industrial firetube boiler installation with underfeed stoker, superheater, economizer and dust separator. Fig. 5 illustrates another type of small industrial plant with sectional watertube longitudinal-drum boiler with traveling-grate stoker and zone regulation. Fig. 6 represents the typical moderate-pressure 2-drum boiler with reciprocating-grate-bar stoker suitable for burning peat or lignite. For these high-moisture fuels, an air preheater, extension furnace and flue-gas return are provided to accelerate drying.

These three examples are included to indicate that a wide variety of boiler types and fuel-burning equipment are still necessary to suit European needs, fuels and water. High efficiency can be incorporated where economically justified, but reliability and fuel versatility are first considerations.

Kraemer Firing System. For fuels requiring a relatively large combustion chamber (low heat-release rate) the radiant boiler of Fig. 7 can be installed in about the same height as a 2-drum 2-nest boiler for pressures up to 900 psi and in large sizes. For the arrangement shown, coal is crushed in a Kraemer pulverizer (POWER, May 1940, p 118) and delivered to the combustion chamber with preheated air to promote combustion of the high-moisture low-volatile fuel. A cast-iron air preheater is employed because of low exit temperature of the flue gas.

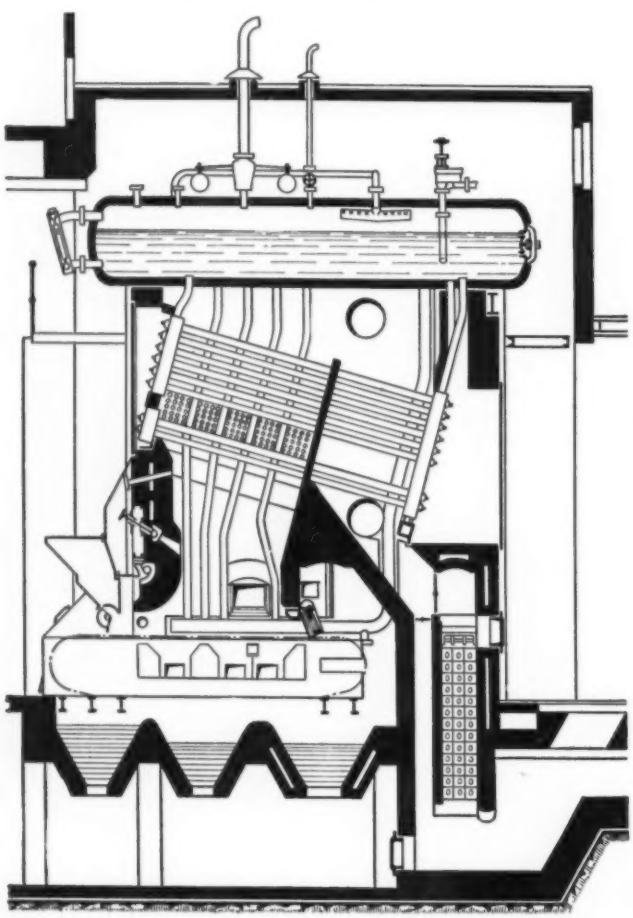


Fig. 5—Typical of middle-pressure range, the conservative sectional boiler for 6600 lb per hr, 425 psi, 660 F, has traveling-grate stoker with zoned air regulation

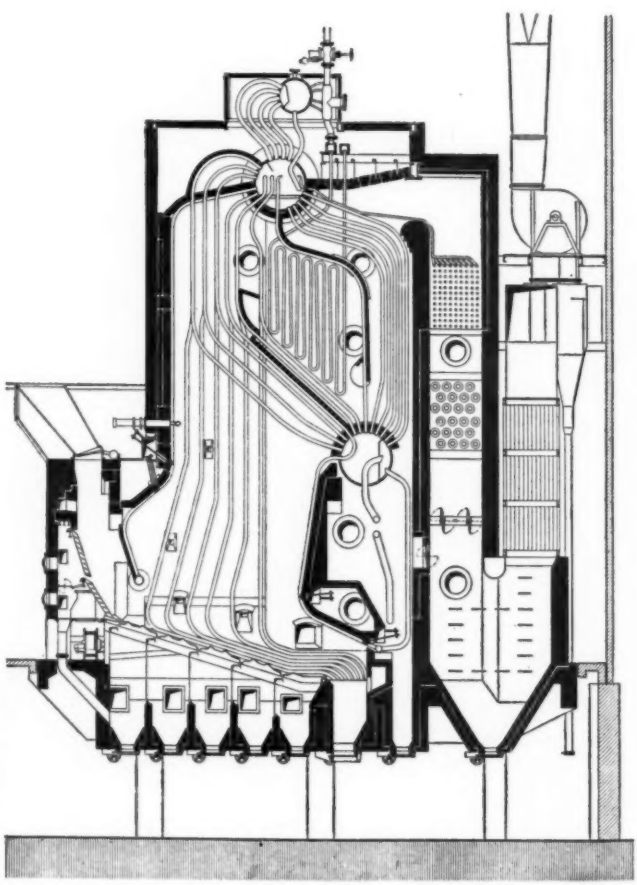


Fig. 6—Two-drum unit for 22,000-lb-per-hr steam, 455 psi, with reciprocating grate-bar stoker for peat or lignite predried in extension furnace and flue-gas return

A typical 3600-kw industrial backpressure plant, Fig. 8, for 1550 psi, 930 F, includes a steam transformer (185/130 psi) for steam supply to a 1600-kw low-pressure turbine. Monotube design permits full utilization of available space. Pressure and temperature are held constant at the superheater outlet of the high-pressure boiler and at the outlet of the intermediate steam reheater by automatic-control devices.

Another monotube installation in France is shown in Fig. 9. All exhaust from the high-pressure turbine is condensed in horizontal steam transformers at 270 psi. The low-pressure 200-psi steam produced is superheated to 540 F in intermediate steam reheaters.

Integral Reheater. For fine semibituminous coal the 2000-psi 930-F steam generator of Fig. 10 is equipped with a traveling-grate stoker with relatively large number of zones. The combustion chamber is unusually large, and the unit has secondary air preheating and fly-coke return. Reheat to 905 F at 510 psi is incorporated within the boiler unit for operation of a relatively new condensing turbine. This unit has seen several years' service with satisfactory temperature regulation under automatic control. Gas passes first through the superheater, then the reheater, economizer and air preheater.

Placing the reheater in the main boiler has several advantages. It is simpler and less expensive than a separately-fired chamber and no separate firing, fuel and ash-transport auxiliaries are needed. Also the plant of Fig. 10 has an over-all efficiency of about 32% at the coupling.

BOILER DEVELOPMENT

Steam Power. Despite the advances in the field of gas turbines and other prime movers, and even considering the economic pressure toward maximum use of hydroelectric potential, Europe will continue to depend greatly on steam power produced from solid fuels. A wide variety of designs will be necessary to suit the individual needs of central stations as well as industrial power plants. Emphasis will continue to be placed on very high efficiency from fuel to electrical output, which will push pressures and temperatures upward to the limit of satisfactory operation and may well result in increased use of reheat. Accumulators and steam transformers for industrial plants will, of course, be utilized to a considerably greater extent than in this country.

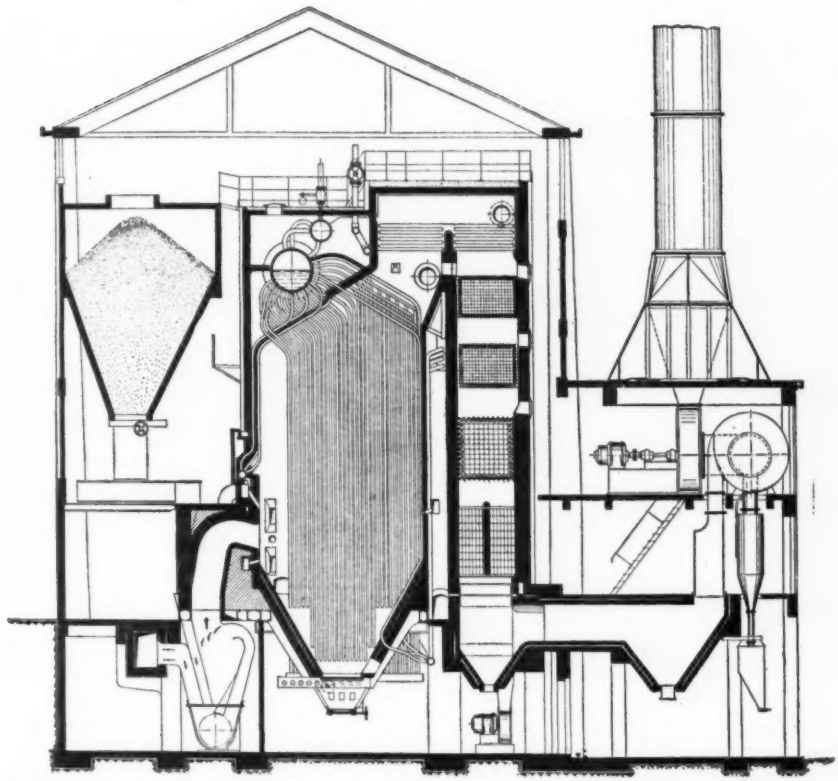


Fig. 7—77,000 lb per hr, 650 psi, 840 F radiant boiler installed in France. Note pulverizer and secondary air ports for high-moisture low volatile fuel

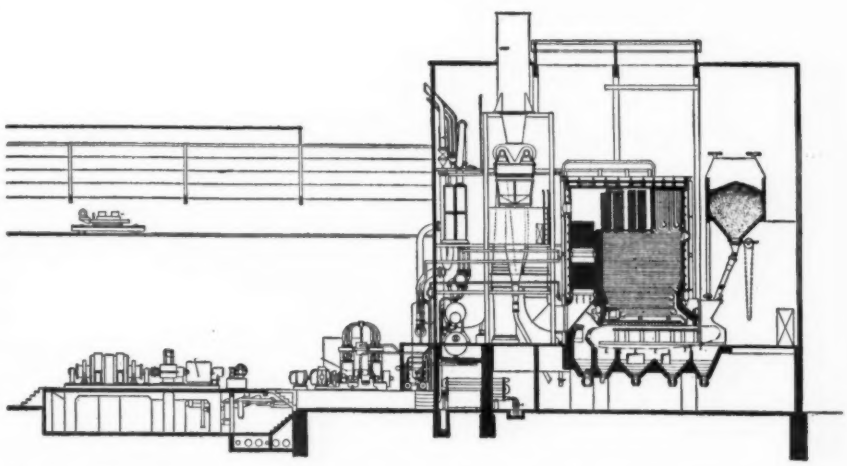


Fig. 8—Monotube steam generator, chemical works in France, supplies 84,000 lb per hr steam at 1560 psi, 930 F to 3600-kw backpressure turbine-generator. Note Ljungstrom air preheater, van Tongeren dust separator, intermediate superheater for 128 psi, 580-F steam supply to the piston-type feedwater pump

Type of boiler first used in Europe and still predominant in small and medium-sized plants is the firetube boiler, which has good steam capacity for fluctuating loads because of its large water-storage capabilities.

With the need arising for larger steam capacities and higher pressures the watertube boiler was designed with one or more drums. The expensive and comparatively poorly utilized heating surface of the firetube boiler was replaced by watertubes, which could carry a much higher heat loading and pressure. At the same time greater flexibility was achieved in dimensions and shape of the furnace.

As working pressure continued rising boiler drums became more expensive and their dimensions limited. Their reserve steam capacity or accumulator action became so low that finally they were but little more than a structural

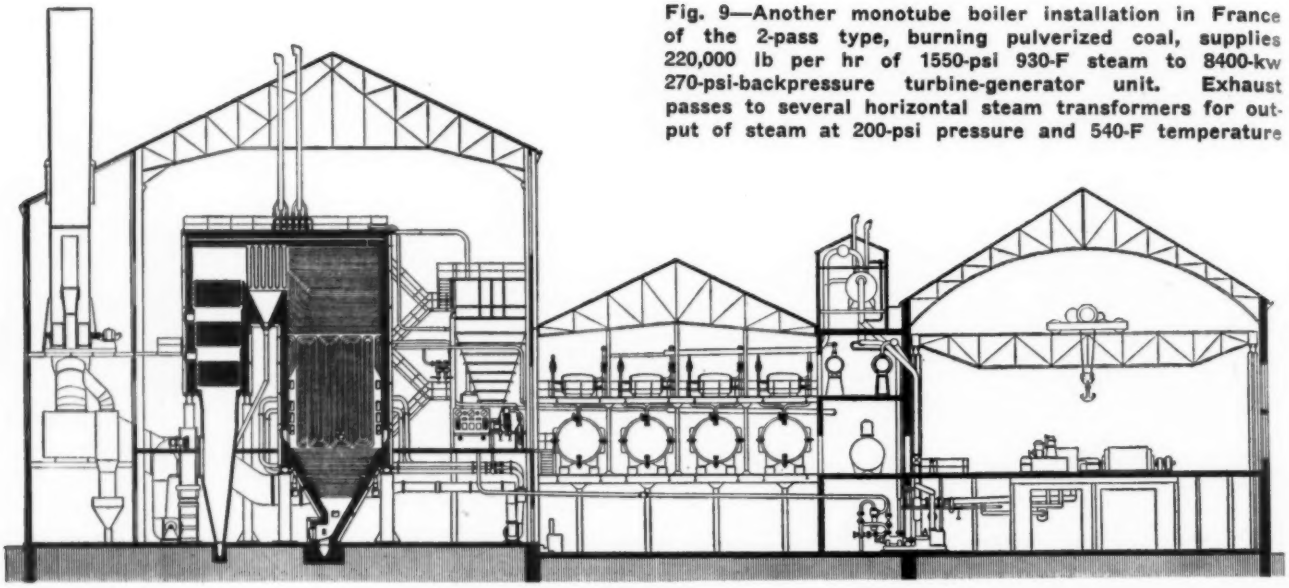


Fig. 9—Another monotube boiler installation in France of the 2-pass type, burning pulverized coal, supplies 220,000 lb per hr of 1550-psi 930-F steam to 8400-kw 270-psi-backpressure turbine-generator unit. Exhaust passes to several horizontal steam transformers for output of steam at 200-psi pressure and 540-F temperature

element in the boiler as a whole. Recognizing this condition Sulzer Bros developed the drumless high-pressure boiler, known as the monotube steam generator.

Monotube Steam Generator. This unit is a forced-circulation once-through boiler working at high pressures with the heating surfaces disposed for high energy-transfer rates. Feedwater supply and steam pressure and temperature are automatically controlled by a special regulating system, Fig. 4. The feedwater pump forces the water and steam through the tube system, the flow being responsive to the combustion rate through a thermostat located after the combustion zone in the boiler. Steam pressure and temperature are automatically maintained constant, and any turbine supplied by the boiler is protected by automatic closing of its throttle valve when the temperature varies outside the required limits.

To parallel American experience, the war has shown European designers the necessity of providing fuel flexibility in their plants, whether for base-load or standby service. This, in addition to low-grade quality of many European fuels, should tend towards allowing only moderate furnace heat releases.

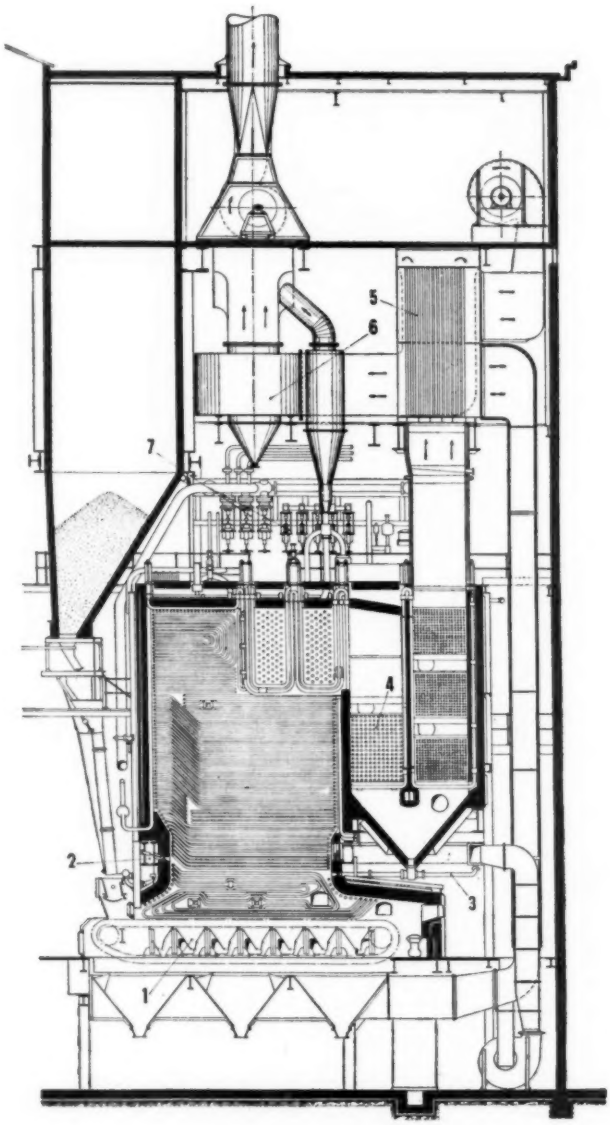


Fig. 10—Flue-gas reheat to 905 F is provided under full-automatic control in 120,000-lb-per-hr 2000-psi 930-F generator with traveling-grate stoker

POWER PERSONALITIES

Men as well as machines make power. Here are on-the-job views of some of these men—their training and experience, their responsibilities, their philosophy of work — the things that make for success in the power field

GEORGE C W GOLEM, chief power engineer, directs the generation of power, including steam and electricity, for Atlantic Wire Co, Branford, Conn., from an office just off the engine room. For 20 years power problems at this plant have been his responsibility, and his solutions are everywhere in evidence.

Today's power plant, for instance, in operation since 1930, grew from his plans and specifications. When a heavier operating schedule jumped power demands in 1940, Golem's creed of complete, accurate records showed unmistakable economy from the use of exhaust steam in a low-pressure condensing turbine. The turbine and cooling-tower facilities were installed and the subsequent record proved the soundness of this solution. Such practical interest in the plant and its operating records, coupled with continued study of new products and practices, helped establish him as a standout among his fellow power engineers.

In the 20 years that he has lived in Branford with his wife in his own home, Golem has kept active his membership in ASME and in NAPE where he is a past president of local No. 10, New Haven. A registered professional engineer in the State of Connecticut, he has served on occasion as consultant. Singing and reading are his hobbies. For years he was active in Branford Musical Arts Society, where he also served as treasurer. His favorite reading is books and magazines that discuss phases of power and power generation; these keep him abreast of the industry.

GEORGE C W GOLEM, strong believer in comprehensive operating records, close contact with operating men and equipment, is comparing operating reports at his desk

APPRENTICESHIP IN MARINE ENGINEERING

Golem comes by his liking for his life's work naturally. He was born in 1883 in Danzig, Germany, into a family whose male members were marine engineers. Most of his boyhood recollections are of Memel where his family moved during his infancy. He recalls that in winter when the harbor froze, his father, a chief engineer, met with the ship's captain, mate and often the second engineer at one another's home to hash and rehash sea experiences. These tales became so much a part of him that he would often prompt the story teller when a particularly choice adventure was repeated.

During these icebound months ship engine-room maintenance was carried out, and always Golem was underfoot. His step into an apprenticeship for marine engineering at 15 was a foregone conclusion. For a period of 30 months he progressed at 6-month intervals through machine, forge, pattern, foundry and assembly shops until he was at last ready to put to sea. At 18 he shipped out of Hamburg on a trip that touched at Antwerp for cargo and then on through Suez Canal to Colombo, Madras and Calcutta. His first year at sea was spent on this run. In his second, he reached New York and went on to South Africa where his ship was tied up three months because of the Boer War.

On his return to Germany he entered college for a prescribed course of subjects to fit him for a limited-license examination. As soon as this objective was gained he shipped out again. He had only one other year ashore at college to fit him for his chief's license, which he secured when 25.

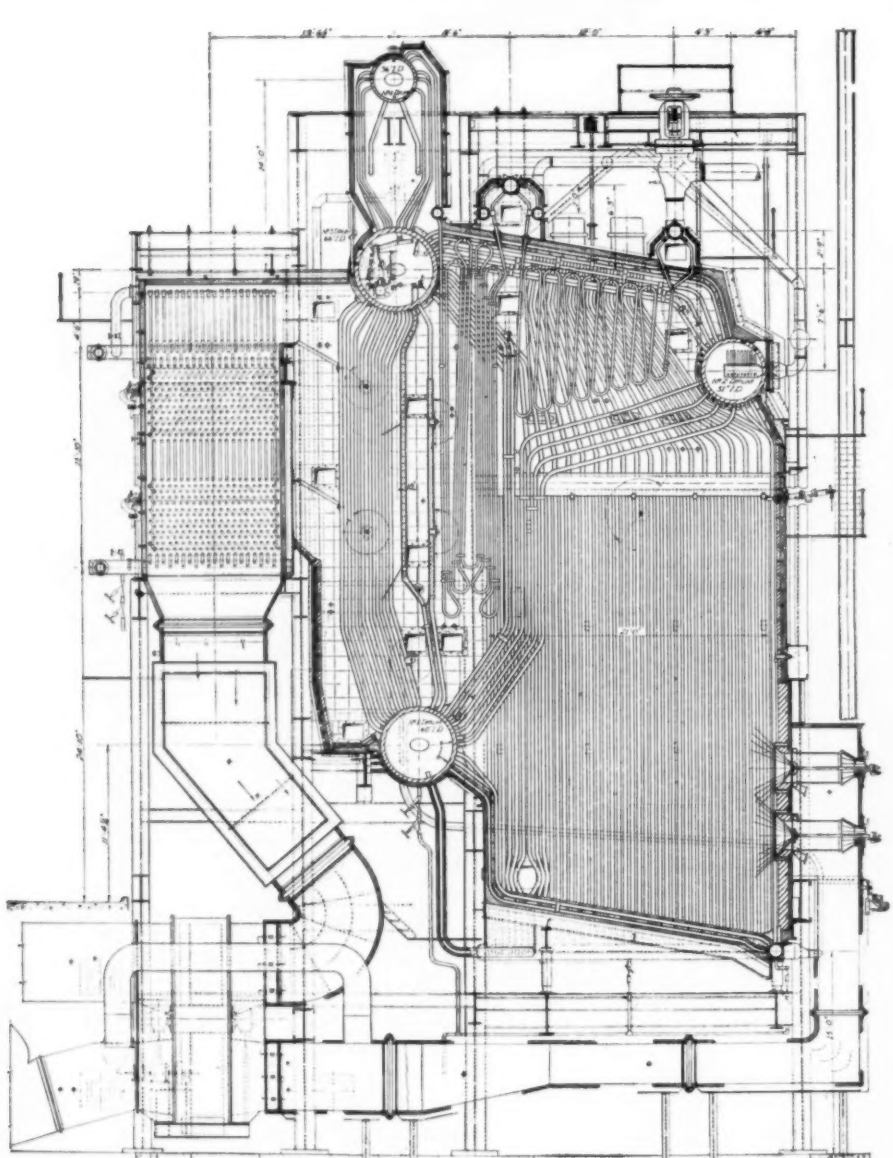
His ship was in New York Harbor at the start of World War I so he was interned for the duration. During this period he felt he would like to try his hand at the production and manufacturing end of the power business. In the reconversion years after that war he sought his niche in this field and finally, as diesel erector for the Lombard Governor Co, went out on an assignment to Atlantic Wire Co.

When Atlantic Wire Co made him an offer he accepted, chiefly because he felt that a return to power operating was just like coming home. Since that day his satisfaction is evident in his efforts to improve the plant, over which he watches with pride, and to help his nine operating men better themselves.

A man operates best who understands equipment, Golem believes. So his men do most of the plant maintenance on their normally off days. He further believes this work draws them closer and promotes exchange of ideas and knowledge.

This exchange, Golem feels, is essential to a man's development. Putting his theory into practice, he writes articles for technical publications, and gives talks at different engineering group meetings on his experiences and methods. Golem sums up his philosophy with this saying, "a man's capacity to learn can be likened to a quart measure—it holds just so much, to add more some must be spilled out."

Second Riley Unit being installed-



CITY OF LOS ANGELES, CALIFORNIA

Harbor Steam Plant

675,000 lbs./hr. 1091 lbs. Pressure. 915°F. Steam
Oil and Gas Fired Riley Steam Generating Unit
Efficiency—86.1% @ 570,000 lbs./hr.

TRADE MARK Rx REGISTERED

RILEY

STOKER CORPORATION, WORCESTER, MASS.

Boston New York Philadelphia Washington Buffalo Cleveland Detroit Chicago St. Louis Cincinnati
St. Paul Kansas City Denver Seattle Portland Los Angeles Houston New Orleans Atlanta Memphis

It will pay you to visit modern Riley Installation

Three More Riley Units ordered

City of Los Angeles has just placed an order with Riley for 3—825,000 lbs. per hour Riley Steam Generating Units. Units will have a design pressure of 1200 lbs. and 900°F total steam temperature.

The first Riley Unit, a 675,000 lbs. per hour unit was installed in 1941. A duplicate of this unit is being installed at the present. The total capacity of the five Riley Units will be 3,825,000 pounds of steam per hour.

The Harbor Steam Plant when the new Riley Units are installed will be one of the largest municipal plants in the country.

Results from existing Riley Units
87.8% Efficiency

PRESSURES AND TEMPERATURES	
Steam Pressure, Boiler Drum	1044 lbs.
Steam Pressure, Superheater Outlet	1001 lbs.
Temp. Water Entering Economizer	406°F.
Temp. Water Entering Boiler	456°F.
Temp. Gases Leaving Boiler	770°F.
Temp. Gases Leaving Economizer	610°F.
Temp. Gases Leaving Air Heater	295°F.
Temp. Air Entering Air Heater	72°F.
Temp. Air Leaving Air Heater	442°F.
Air Pressure Entering Air Heater	5.8″
Air Pressure at Burners	4.0″
Draft in Furnace	0.1″
Draft at Boiler Outlet	1.9″
Draft at Economizer Outlet	2.6″
Draft at Air Heater Outlet	4.6″

HOURLY QUANTITIES	
Actual Steam Flow	538,924 lbs.
Weight of Fuel Fired	35,954 lbs.
B.T.U./lbs. of Oil	18,326 B.T.U.
B.T.U. Heat Release	29,250 B.T.U.

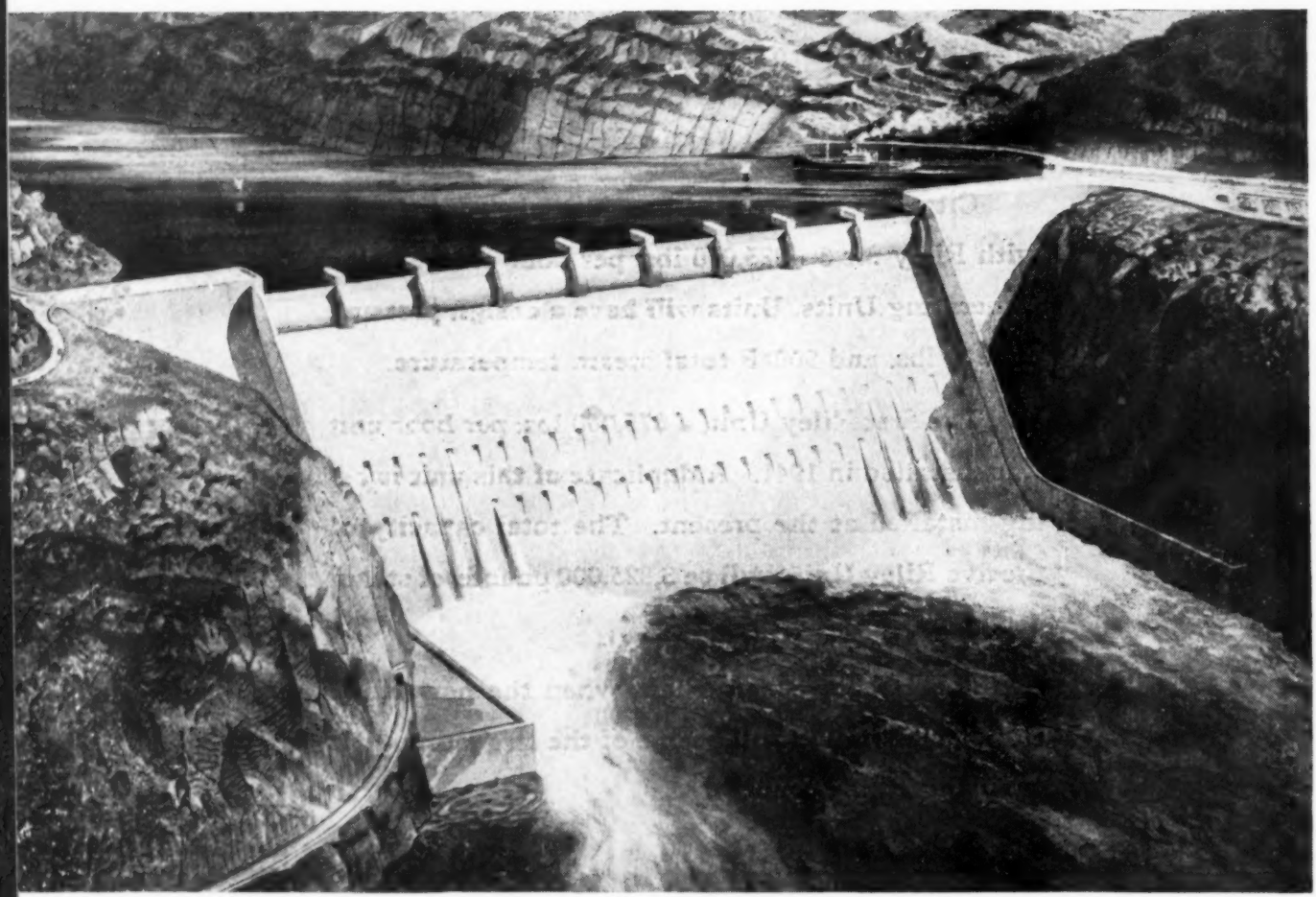
HEAT BALANCE		
Heat Absorbed by Unit	16,090	87.8
Loss Moisture in Fuel	1	0.0
Loss Hydrogen in Fuel	1097	6.0
Loss Moisture in Air	7	0.1
Dry Gas Loss	883	4.8
CO	0	0.0
Combustible in Refuse	0	0.0
Radiation and Unaccounted for	248	1.3
Total	18,326	100%

A survey of your power plant by a consulting engineer will possibly show ways of making surprisingly large savings in power costs

COMPLETE STEAM GENERATING UNITS

BOILERS • PULVERIZERS • BURNERS • STOKERS • SUPERHEATERS • FLUE GAS SCRUBBERS
ECONOMIZERS • WATER-COOLED FURNACES • STEEL-CLAD INSULATED SETTINGS • AIR HEATERS

before purchasing Boiler or Fuel Burning Equipment



An artist's conception of Yangtze Gorge Dam. Planned as the biggest concrete dam of all time, it is the kingpin of China's plans to rebuild Yangtze valley providing flood control, navigation, power and water for irrigation

CHINA PLANS WORLD'S LARGEST HYDROELECTRIC POWER PROJECT

▶ AIDED BY ENGINEERS of the U. S. Bureau of Reclamation, the government of China is planning development of the largest irrigation and hydroelectric power project the world has ever known. Key feature of the project, which is designed to revitalize the heavily populated, hunger-ridden, flood-menaced Yangtze valley, will be a huge dam, above, in the gorge of the river about 300 miles east of Chungking (see map on opposite page).

This dam as planned will reach like a skyscraper higher than Boulder Dam on the Colorado River, now the world's highest (750 feet compared with 726). The largest pyramids are dwarfed by its hulking mass—a third greater than Grand Coulee Dam on the Columbia River, the present title holder (15 million cubic yards to almost 10 million). A record 250-mile reservoir backed up behind the dam (50 million acre-feet capacity compared to Boulder's approximate 31 million) will store water for (1) the mammoth irrigation project (2) maintaining navigation (3) flood control and (4) power production.

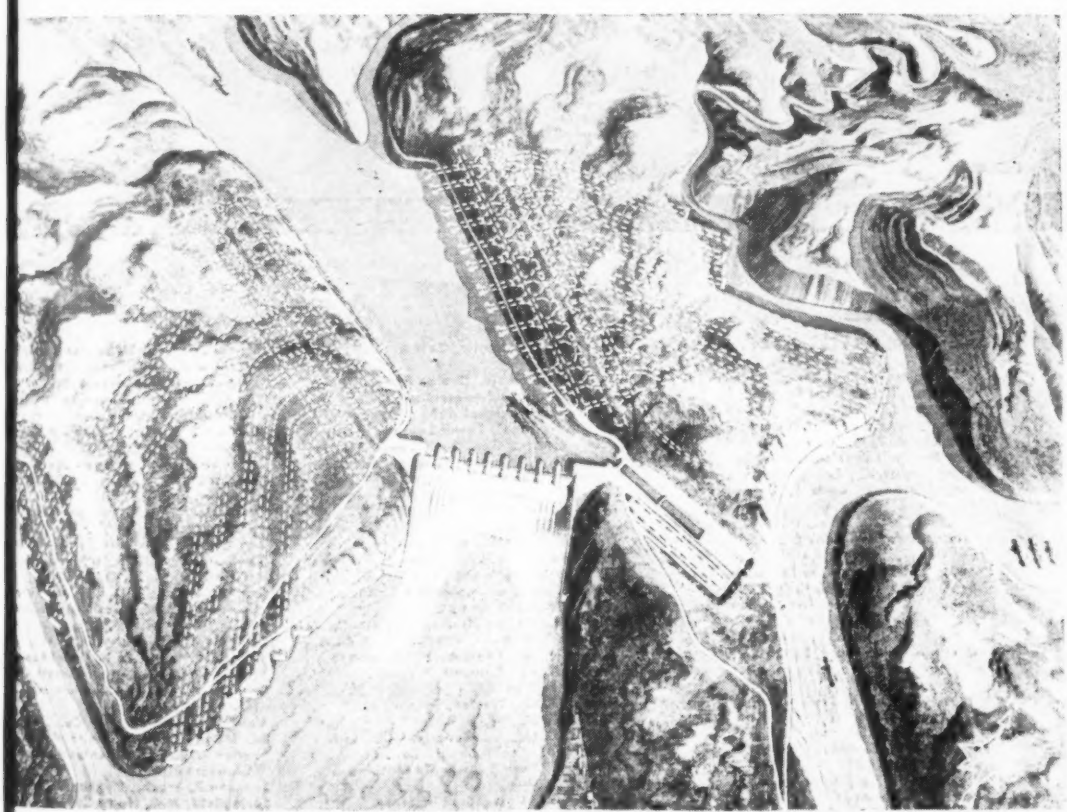
The dam will impound waters of the Yangtze to provide irrigation for 10,000,000 acres of land, and also protect the valley against floods. Plans call for construction of the world's largest hydroelectric plant, with a generating capacity three times that of the combined plants at Boulder, Grand Coulee and Shasta.

China plans to utilize this power production to develop the resources of the valley more fully, to repay the estimated billion-dollar cost of the dam, and to raise living standards in the area beyond anything previously existent. The dam will turn the flow of the Yangtze through 96 Coulee-type 108,000-kw turbine-generators nested in tunnels cut into the solid rock walls of the gorge above the dam. All main power facilities except the switchyard will be underground (see pictures on opposite page).

The Bureau of Reclamation, U. S. Department of the Interior, is participating in the project's plans under a contract between the U. S. Government and the National Resources Commission of China. Commissioner of Reclam-

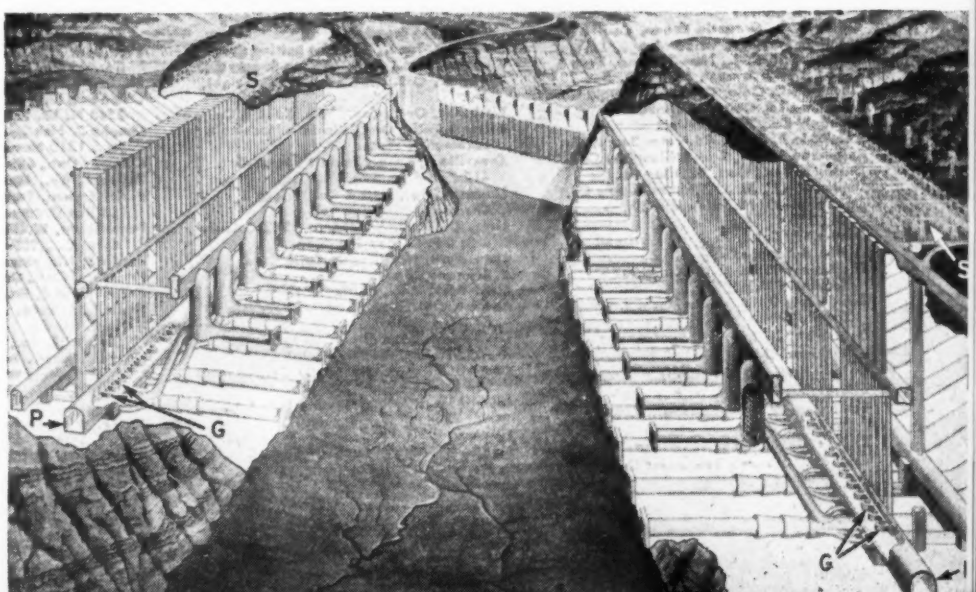
ation Michael W Straus states that work is under way and that the government of China has advanced $250,000 toward payment of the cost of the Bureau's services. This is the first installment toward the total estimated payment of $500,000 that will be required.

Designs and plans are in progress at the Denver office, Bureau of Reclamation, under supervision of Chief Engineer Walker R Young. Preliminary over-all designs were prepared by John L Savage, until recently chief designing engineer of the Bureau, and world-renowned designer of Boulder, Grand Coulee and other dams. He is participating in the work as consulting engineer for the Chinese Government.



Above: China's greatest river, the Yangtze, is 2500 mi long, draining 690,000 sq. mi. Control of its waters will prevent floods, provide for irrigating 10 million acres of land, and generate vast quantities of hydroelectric power to stimulate industrial development in China

Left: Yangtze River Dam, imbedded in granite walls and bed of Ichang Gorge. Dash lines indicate the buried works of what will be the world's greatest power plant. Tunnels lead water from the reservoir to 150,000-hp turbines that discharge through other tunnels



Right: With the solid rock walls of Ichang Gorge cut away, the intricate power-plant works appear. Installed in each of two powerhouse tunnels, P, are 48 generators, G, of 108,000 kw each. Design provides ultimate capacity of 10,360,000 kw, or 14,400,000 hp, more than three times ultimate capacity of plants at Boulder, Shasta, and Grand Coulee Dams. All works and equipment are underground with exception of switchyards S, top right and left of photo

factory representatives

Abbey Steam Spec. Co.
Atlanta 3, Ga.
Advance Engineering Co.
New York 7, N. Y.
Geo. B. Allan & Co.
Dallas 1, Texas
Baldwin Supply Co.
Charleston 26, W. Va.
Barrett-Christie Co.
Chicago 6, Ill.
Brogan & Co.
Philadelphia 7, Pa.
E. B. Carr
Des Moines 9, Iowa
Coblentz Equipment Co.
Erie, Pa.
R. S. Eastman Co.
Pittsburgh 22, Pa.
Evansville Supply Co.
Evansville 10, Ind.
Files Steam Spec. Co.
Boston 10, Mass.
Arthur Forsyth Co.
Seattle 4, Wash., Portland 5, Ore., Spokane, Wash.
Graft-Pelle Co.
Louisville 2, Ky.
Hamacher & Williams
Milwaukee 3, Wis.
Hayden Supply Co.
Grand Rapids, Mich.
Hendrie & Bolthoff Mfg. & Sup. Co.
Denver 17, Colo.
Herr Steam Spec. Co.
Buffalo 15, N. Y.
The Hopton Co.
Syracuse 2, N. Y.
Hughes Machinery Co.
Kansas City 2, Mo.
Indianapolis Belting & Sup. Co.
Indianapolis 9, Ind.
John W. Ladlow
Phoenix, Ariz.
Lee, Pace & Turpin
Salt Lake City 9, Utah
Leinart Engineering Co.
Knoxville 5, Tenn.
Louisiana Steam Equip. Co.
New Orleans, La.
Milby & McKinney
Baltimore 2, Md.
O'Brien Equipment Co.
St. Louis 3, Mo.
Power Equipment Co.
Memphis 4, Tenn.
Albert C. Price Co.
Minneapolis 15, Minn.
Refrigerating & Power Spec. Co.
San Francisco 7, Calif.
A. T. Shepherd Co.
Richmond 10, Va.
J. W. Sherman
Tampa 2, Fla.
John E. Smith
Duluth 2, Minn.
Smith-Monroe Co.
South Bend 23, Ind.
Southeastern Products Corp.
Birmingham 1, Ala.
A. F. Squier
Detroit 26, Mich.
Steam Economies Co.
Wooster, Ohio
Guy L. Warden
Los Angeles 15, Calif.
General Equipment, Ltd.
Vancouver, B. C.
Kipp-Kelly, Ltd.
Winnipeg, Man.
Arthur S. Leitch Co., Ltd.
Toronto 5, Ont.
Preston, Phipps Inc.
Montreal, Que.

Around the world with ARMSTRONG STEAM

parts and stocks

Akron 11, Ohio, Hdwe. & Supply Co.
Asheville, N. C., Tidewater Supply Co.
Atlanta 3, Ga., J. M. Tull Metal & Supply Co.
Augusta, Ga., S. Donald Fortson, 901 Reynolds
Austin 1, Tex., Walter Tips Co., Box 55
Baltimore 2, Md., Milby & McKinney, 139 Fallaway
Bangor, Maine, R. B. Dunning & Co.
Battle Creek 100, Mich., Galloup Pipe & Supply Co.
Binghamton 61F, N. Y., Ellis W. Morse Co., 81 State
Birmingham 1, Ala., Southeastern Prod. Corp.
Boston 10, Mass., Files Steam Spec. Co.
Brazil, Hero Hidroelectica, Caixa Postal 2835, Sao Paulo
Brockton 2, Mass., Corcoran Supply Co.
Buenos Aires, Argentina, Will L. Smith, S. A.
Buffalo 15, N. Y., Herr Steam Spec. Co.
Canton 2, Ohio, Canton Supply Co.
Caracas, Venezuela, S. A., Joaquin Avellan, Sur 25 Los Caobos
Cedar Rapids, Iowa, Cedar Rapids Pump and Supply Co.
Charleston H, S. C., Charleston Supply Co.
Charleston 26, W. Va., Baldwin Supply Co.
Chicago 6, Ill., Barrett-Christie Co., 108 N. Clinton
Chile, S. A., Gregorio Kogan, Casilla de Correo No. 594, Valparaiso
Christchurch, C. I., New Zealand, Vale & Co., 141-3 Armagh St., (P.O. Box 1050)
Cincinnati 2, Ohio, Cincinnati Supply Co.
Cleveland 14, Ohio, W. M. Pattison Supply Co., 777 Rockwell
Columbia E, S. C., Tidewater Supply Co.
Columbus 15, O., Ross-Willoughby Co.
Dallas 1, Tex., Geo. B. Allan Co.
Dayton 2, O., M. J. Gibbons Supply Co.
Decatur A-60, Ill., Field and Sharb, Box 310
Denver 17, Colo., Hendrie & Bolthoff Mfg. & Supply Co.
Des Moines 9, Ia., E. B. Carr, 307 Securities Bldg.
Des Moines 9, Ia., State Mach. & Supply Co.
Detroit 26, Mich., A. F. Squier, 600 Michigan Bldg.
Duluth 2, Minn., J. E. Smith
Eau Claire, Wis., W. H. Hobbs Co.
Edmonton, Alberta (Canada), H. Kelly Plumbing & Heating Co.
El Paso, Texas, Geo. S. Thomson Co.
Erie, Pa., Coblentz Equipment Co.
Evansville 10, Ind., Evansville Supply Co.
Falconer, N. Y., Mr. Glenn A. Crick
Fall River, Mass., Fall River Steam & Gas Pipe Co., 205 Bedford St.
Fort Wayne 3, Ind., Neff Engineering Co.
Frankfort, Ky., Industrial Supply Co.
Grand Rapids 2, Mich., Hayden Supply Co.
Green Bay, Wis., Nelson Machinery Co.
Greensboro, N. C., Odell Mill Supply Co.
Haifa, Palestine, Caloria 63 Kingsway (P. O. Box 598)
Hamilton, Ontario, Can., H. C. Burton
Harrisburg, Pa., Appleby Bros. & Whittaker Co.
Havana, Cuba, Mora-Oña Company, S.A., San Nicolas 105, Apartado 1088
Honolulu 3, T. H., Von Hamm-Young Co., Ltd.
Houston 1, Tex., Geo. B. Allan & Co., % Universal Warehouse, P. O. Box 99
Huntington 6, W. Va., Banks-Miller Supply Co.
Indianapolis 9, Ind., Indianapolis Belting & Supply Co.
Jackson, Miss., Miss. Fdry. & Mach. Co.
Jackson, Tenn., Southern Supply Co., Box 1829
Jacksonville 5, Fla., Ralph Payne Co., 3621 St. John Ave.
Kalamazoo 3, Mich., Galloup Pipe & Supply Co.
Kansas City 2, Mo., Hughes Machinery Co., 4034 Broadway
Kingsport, Tenn., Slip-Not Belting Corp.
Kingston, Ont., Can., Wagren Supply Co.
Kitchener, Ont., Can., Bennett & Wright, Ltd.
Kitchener, Ont., Can., Wm. Knell & Co.
Klamath Falls, Ore., Klamath Machine & Locomotive Works
Knoxville 5, Tenn., Leinart Engrg. Co., 412 East Fifth Ave.
Lancaster, Pa., Herr & Co., Prince & Chestnut
Lima, O., Harry Wright, Jr., 302 Colonial Bldg., P. O. Box 201
Lima, Peru, N. Ellinger, Calle Coca, Bejarano 264
Little Rock, Ark., Hollis & Co.
London, Ont., Can., Empire Brass Mfg. Co., Ltd.
Los Angeles 15, Calif., Guy L. Warden, 209 W. 12th St.
Louisville 2, Ky., Graft-Pelle Co., 309 W. Main St.
Lowell, Mass., Middlesex Machine Co., 40 Lee St.
Lynchburg, Va., Noland Company, Inc.
Madison 1, Wis., Wisconsin Fdry. & Mach. Co.
Manila, P. I., Atlantic, Gulf & Pacific Co. of Manila
Medellin, Colombia, Ospino Perez & Cia, S.A., Dpto. de Representaciones, Apartados Nacional 461
Memphis 4, Tenn., Power Equipment Co.
Meridian, Miss., Gen. Sup. & Mach. Co.
Mexico, D. F., Mexico, Abraham Carlos Miselem, Juarez 60, Despachos 407-408
Miami 18, Fla., Fla. Fuel Oil, Inc., 950 W. 73rd
Middlesex, England, Drayton Regulator & Instrmt. Co., Ltd., W. Drayton
Milwaukee 3, Wis., Hamacher & Williams, 2540 West Wells St.
Minneapolis 15, Minn., Albert C. Price Co., 257 Fourth Ave., S.
Moline, Ill., Moline Heating & Const. Co.
Montevideo, Uruguay, Will L. Smith, S. A.
Montreal, P. Q., Engineering Equipment Co., Ltd., 620 Cathcart St., New Birks Bldg.
Montreal, P. Q., Preston, Phipps Inc., 637 Craig St., W.
Montreal, P. Q., Jas. Robertson Co., Ltd.
Muncie, Ind., Knapp Supply Co.
Nashville 3, Tenn., Nashville Machine & Supply Co.
New Bedford, Mass., Babbitt Steam Specialty Co.
New Haven 3, Conn., Hoyt-Grant Co.
New Orleans, La., Louisiana Steam Equipment Co., 233 N. Peters
New York 7, N. Y., Advance Engineering Co., 69 Dey St.
Norfolk 1, Va., Tidewater Supply Co.
Oklahoma City, Okla., Ward R. McGavren, 2340 N. W. 12th St.
Omaha 2, Neb., Air Conditioning Utilities, Inc., 1810 Harney
Ottawa, Ont., Can., Pennock Engrg. Co.
Paducah, Ky., Henry A. Petter Supply Co.
Paris, France, Trouvay et Cauvin, 183 Rue Ordener
Parkersburg, W. Va., Automatic Stoker & Engrg. Co., 207-8 Richardson Bldg.
Peoria 2, Ill., Hagerty Bros. Co.
Peterboro, Ont., Can., W. R. Turner
Philadelphia 7, Pa., Brogan & Co.
Phoenix, Arizona, John W. Ladlow, P. O. Box 1784
Pittsburgh 22, Pa., R. S. Eastman Co.
Pittsfield, Mass., Robbins-Gamwell Corp.
Portland 2, Me., W. L. Blake & Co.
Portland 5, Ore., Arthur Forsyth Co.
Providence 3, R. I., R. I. Sup. & Eng. Co.
Racine, Wis., Thomas Sup. Co., 1430 9th
Regina, Sask., A. A. Brown, 1724 Cornwall
Richmond 5, Va., Phipps & Bird, Inc.
Richmond 10, Va., Allan T. Shepherd Co.
Roanoke 8, Va., Tidewater Supply Co.
Rochester 7, N. Y., Herr Steam Spec. Co., 1 Mt. Hope Ave.
Rome, Ga., Battey Machine Co., Inc.
St. Catharines, Ont., Can., J. Pearl
St. Joseph 1, Mo., Missouri Water & Steam Supply Co.
St. Louis 3, Mo., O'Brien Equipment
Salt Lake City 1, Utah, Lee, Pace & Turpin, 142 So. Fifth West St.
San Antonio, Tex., San Antonio Mach. & Supply Co.
San Francisco 7, Calif., R. & P. Spec.
San Juan, Porto Rico, Ulpiano Casa Portilla Bldg. (P. O. Box 3087)
Sao Paulo, Brazil, S. A., Hero Hidroelectrica, S.A., Rua Florencio de 610 (Caixa Postal 2835)
Scranton 3, Pa., Harry G. Murphy Co., 802 Scranton National Bank
Seattle 4, Wash., Arthur Forsyth Co.
Shreveport, La., Cunningham Mach. Corp., 701 Ricon St.
Sioux City, Ia., Wigman Co., 313
South Bend 23, Ind., Smith-Monroe
Spartanburg, S. C., Montgomery & Crawford, Inc.
Spokane 7, Wash., Hughes & Co.
Springfield, Mo., Harry Cooper Sup.
Springfield, O., Ross-Willoughby Co.
Sudbury, Ont., Cochrane Dunlop Hdw. Ltd.
Swastika, Ont., Can., H. C. Burton
Syracuse 2, N. Y., The Hopton Co.
Tampa 2, Fla., J. W. Sherman, 404
Toledo 3, Ohio, Hardy-Dischinger Co.
Topeka, Kans., Topeka Steam Boiler
Toronto, Ont., Can., Arthur S. Leitch Ltd., 1123 Bay St.
Trenton 6, N. J., Warren, Balderston
Troy, N. Y., Troy Belting & Supply Co.
Valparaiso, Chile, Gregorio Kogan, de Correo No. 594
Vancouver, B. C., General Equipment 319 West Pender St.
Victoria, B. C., Andrew Sheret, Ltd.
Washington 2, D. C., Thos. Somerv
West Point, Ga., Batson-Cook Co.,
Wheeling, W. Va., Trimble & Lutz Supply Co.
Wichita 1, Kans., J. M. O'Connor Co.
Williamsport 3, Pa., E. Keeler Co.
Windsor, Ont., Can., J. T. Wing & Co.
Winnipeg, Manitoba, Kipp-Kelly, Ltd.
Winston-Salem 1, N. C., Atlas Supply
Wooster, O., Steam Economies Co.
Worcester 8, Mass., Washburn-Garfield
York, Pa., The Careva Co., 545 E. P
Zanesville, O., The Roekel Company

TRAPS . . .

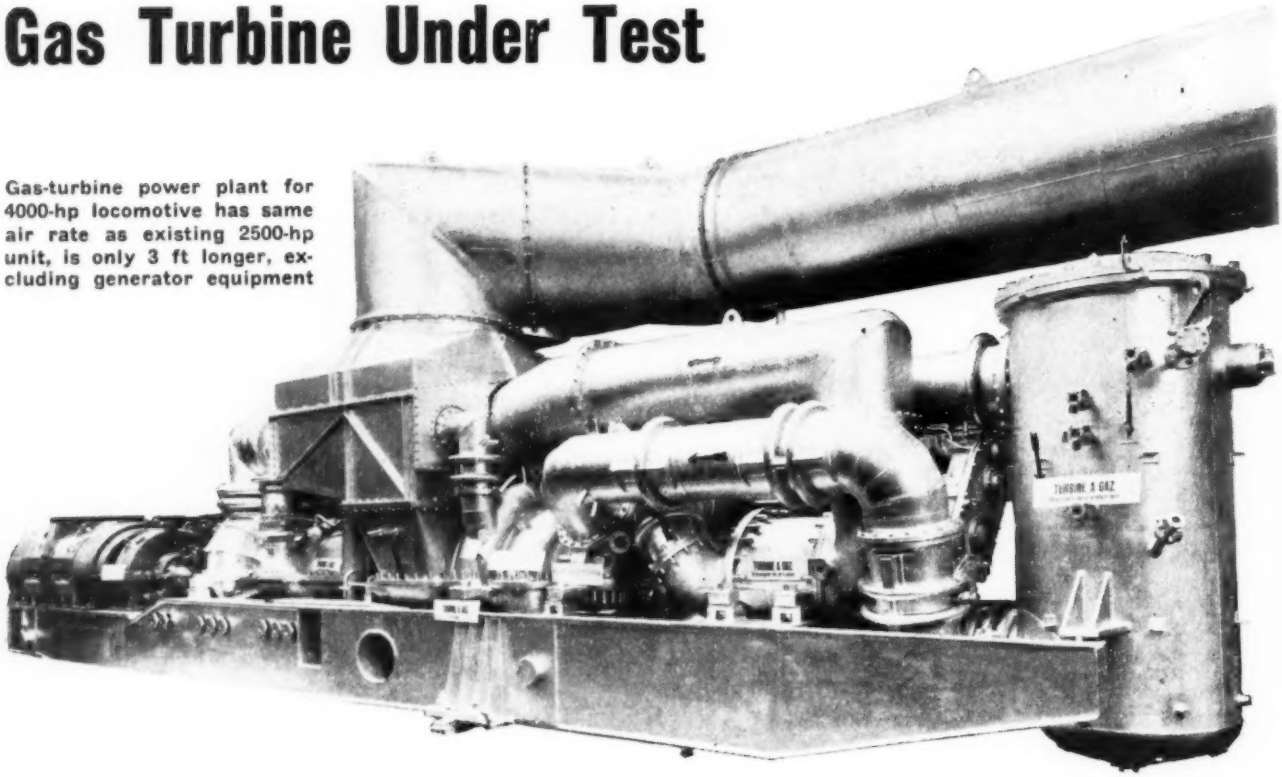
ARMSTRONG representatives are factory trained in the installation, operation, and maintenance of Armstrong Steam Traps and other Armstrong products. Take advantage of the engineering service these people can give you. Armstrong stock jobbers, likewise, have been selected to extend facilities to virtually every industrial center in the United States and Canada. Overseas, similar care has been taken in appointing agents who have outstanding sales, service, and engineering facilities. This is another reason why it pays to standardize on Armstrong Traps — more than a million in service throughout the world!

ARMSTRONG · INVERTED BUCKET · STEAM TRAP

ARMSTRONG *Machine Works*

812 Maple Street • Three Rivers, Michigan

New Locomotive Power Plant and Largest Gas Turbine Under Test



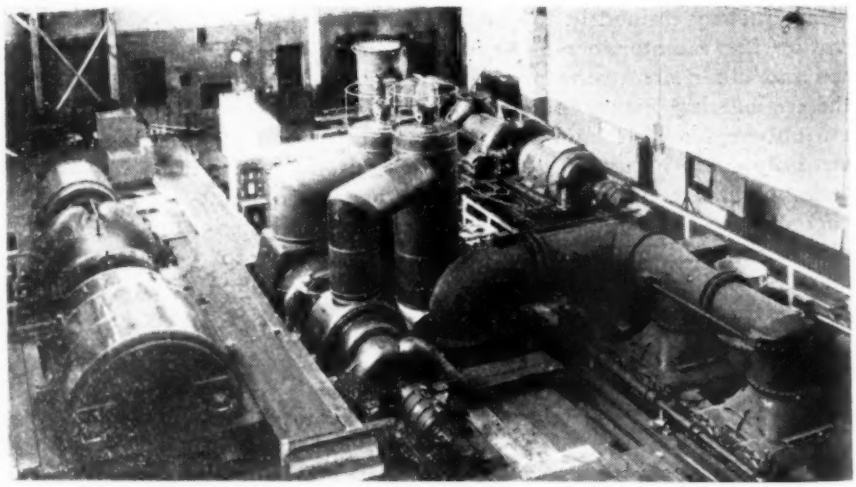
Gas-turbine power plant for 4000-hp locomotive has same air rate as existing 2500-hp unit, is only 3 ft longer, excluding generator equipment

► REPORTING ON recent gas-turbine developments at the ASME Semiannual Meeting in Detroit, Paul R Sidler, president, Brown Boveri Corp, N. Y., cited the new 4000-hp locomotive power plant now under test and the 10,000-kw standby set for the Filaret plant, Bucharest, Rumania, on which tests have been completed. Photos of these units have just become available.

Building on experience gained from operation of the 2500-hp locomotive constructed for the Swiss Federal Railways in 1939, Brown Boveri engineers have, by refinements in design of standard components and introduction of novel features, produced a 4000-hp power plant that has the same air rate as the previous unit and is only 3 ft longer, exclusive of generator equipment. Substantially higher over-all efficiency is also obtained by design developments that can only be described in detail when they have been thoroughly tested.

A total of ten commercial gas-turbine sets are in production at the Brown Boveri shops: eight were listed in POWER, Nov 1945, p 65, and since that time two 4000-kw natural-gas-fired units for an oil refinery in Southern Iran have been ordered. Of these sets, the 10,000-kw unit for Bucharest, Rumania, has been completed and tested. This is a 2-shaft machine, with intercooling and reheating, but without regenerator as it will be used for standby service.

A large series of tests were run on this unit, to check starting characteristics and operation over the entire load range. Tests showed particularly good overload capacity, reaching a maximum of 12,000 kw with inlet air at 68 F and maximum continuous throttle temperature of 1112 F. About one point higher efficiency than guarantee was obtained at all loads: 23% at full load, 21% at three-quarter, 17% at half, and 10% at one-quarter. The set required about four minutes to start from standstill to full speed. On test, it required another 3.5 minutes to reach full load, but this was limited by the ability of the water resistor to pick up load, and in an actual installation the turbine could follow a considerably faster rate of load increase.



Largest gas-turbine set yet built, 10,000-kw Bucharest standby unit is shown assembled for test. Low-pressure turbine, compressor and generator are at left, high-pressure set and combustion chambers at center and intercoolers at extreme right. At upper right is the partly assembled 4000-kw set for Chimbote, Peru

LABOR DAY • 1946

—Time for wise union leadership

LABOR DAY, 1946, finds one hopeful element in the relations between American management and labor which was not there on Labor Day, 1945. It comes in recent expressions by a number of national leaders of organized labor that increased "real" wages depend upon *increased productivity,* i.e. increased output per man-hour. Increased money wages which are promptly offset by higher prices do nobody any good.

If these expressions, *which still remain to be substantiated by practical performance,* come to be accepted by the rank and file of labor in each community, Labor Day, 1946, can usher in a period of great and perhaps unprecedented improvement in the economic wellbeing of wage earners—as well as the wellbeing of the country at large. If, on the contrary, they remain merely window dressing and there is a continuation of the post V-J Day process of increasing wages and then prices, the outcome can only be the bursting of an inflationary bubble, with attendant suffering for workers and the community generally.

Competition requires management to bear down heavily on increased labor productivity as a prelude to wage increases. Management, however, has rarely made a more forthright statement on the importance of increasing labor productivity than that contained in a recent issue of LABOR'S MONTHLY SURVEY, an official publication of the American Federation of Labor.

William Green, the Federation president, led off with a "message to American workers." He remarked, "Our major need is increased volume of production." Observing that "wage increases this spring have been paid for by raising prices," the survey itself goes on to say that "Today America's ability to raise wages without increasing prices and living costs depends on increasing productivity in civilian industries . . . Here is the challenge to free labor and free enterprise today: *Cooperate to increase productivity and raise living standards without strikes.*" (Italics supplied.)

The importance of increasing production was also recently stressed by Walter Reuther, President of the United Automobile Workers, C.I.O., who remarked that his union "is just as eager as management to get the (automobile) industry into maximum production." In taking this general line he was in accord with the position of Philip Murray, head of the C.I.O., who in a book, "Organized Labor and Production" written with Morris L. Cooke, remarks that, "The modern labor leader also realizes that to receive a good day's pay a man must do a good day's work and that *increased productivity has been the vital factor in the country's industrial supremacy and its relatively high wage scale.*" (Italics supplied.)

In citing increased productivity as the key to increased "real" wages these labor leaders—and management—have the historical record entirely on

SPOT CHECK ON LABOR OUTPUT

In the absence of reliable general statistics on what has happened to productivity of labor since V-J Day (because of strikes and reconversion complications) the McGraw-Hill Publishing Company asked the executives of a cross section of American industry to report their own impressions. The questions asked and summaries of the replies, which varied markedly from industry to industry and plant to plant, follow.

Question No. 1. How well have workers performed since V-J Day as compared to their pre-war effort?

Answer. Worker effort has been below pre-war. There are exceptions, particularly among older and more experienced workers; and there are quite a few signs of improvement.

Question No. 2. How much headway have you been able to make since V-J Day in improving labor productivity by better equipment and organization?

Answer. Some headway is generally being made, but it has been greatly retarded by inability to get new equipment and, in some cases, by lack of labor cooperation in improvements in organization.

Question No. 3. How much improvement in equipment and organization is to be anticipated in your business over the next year?

Answer. Marked improvement in productivity (in a few cases as much as 20 per cent) can generally be made if there is sustained production and full cooperation between labor and management.

their side. In the 40 years prior to the outbreak of World War II output per man-hour for the country as a whole was approximately doubled. Over the same period the "real" hourly earnings of industrial workers were also approximately doubled. There were, of course, great variations in the increase of output per man-hour from one line of activity to another. Also, there were periods when increases in "real" wage rates lagged behind increases in productivity. But for the 40 year period as a whole and the economy as a whole there is no mistaking the fact that the route to increased "real" wage rates was increased productivity.

Three economic factors played major roles in this doubling of production per man-hour which has made America the industrial marvel of the modern world. One was the skill and diligence of American workers. A second was the skill and diligence of American management in organizing production. A third was the improvement of machinery and the increased application of power to it.

Wartime Record

During World War II this sustained increase in the productivity of labor in *civilian* manufacturing industries, which had averaged about 3 per cent a year, was brought to an abrupt halt. Much of the most efficient segment of the nation's labor force went to war or war industry. Also, civilian industry was starved for new equipment while we equipped our arsenals. The result was that the productivity of labor in those civilian manufacturing industries for which the government keeps records actually declined throughout most of the war. By 1945 it was no higher than in 1941, whereas, if it had maintained the long run average, it would have been about 12 per cent higher. In the meantime, however, average hourly wages in these civilian industries had increased about 40 per cent.

In *war* industry, which started from low levels of production at strange tasks, there were substantial increases in output per man-hour. Many of these increases involved new processes, improved techniques, and better machines which can be adapted over a period of time to the improvement of productivity of labor in civilian industry.

Since V-J Day, however, labor, led on by a misguided government, has had its sights on higher money wages instead of improving productivity which would have laid the foundation for increased "real" wages. Consequently, debilitating industrial strife ended in a round of wage increases which, in the absence of increased productivity, is being washed out by higher prices.

To Keep Production Rolling

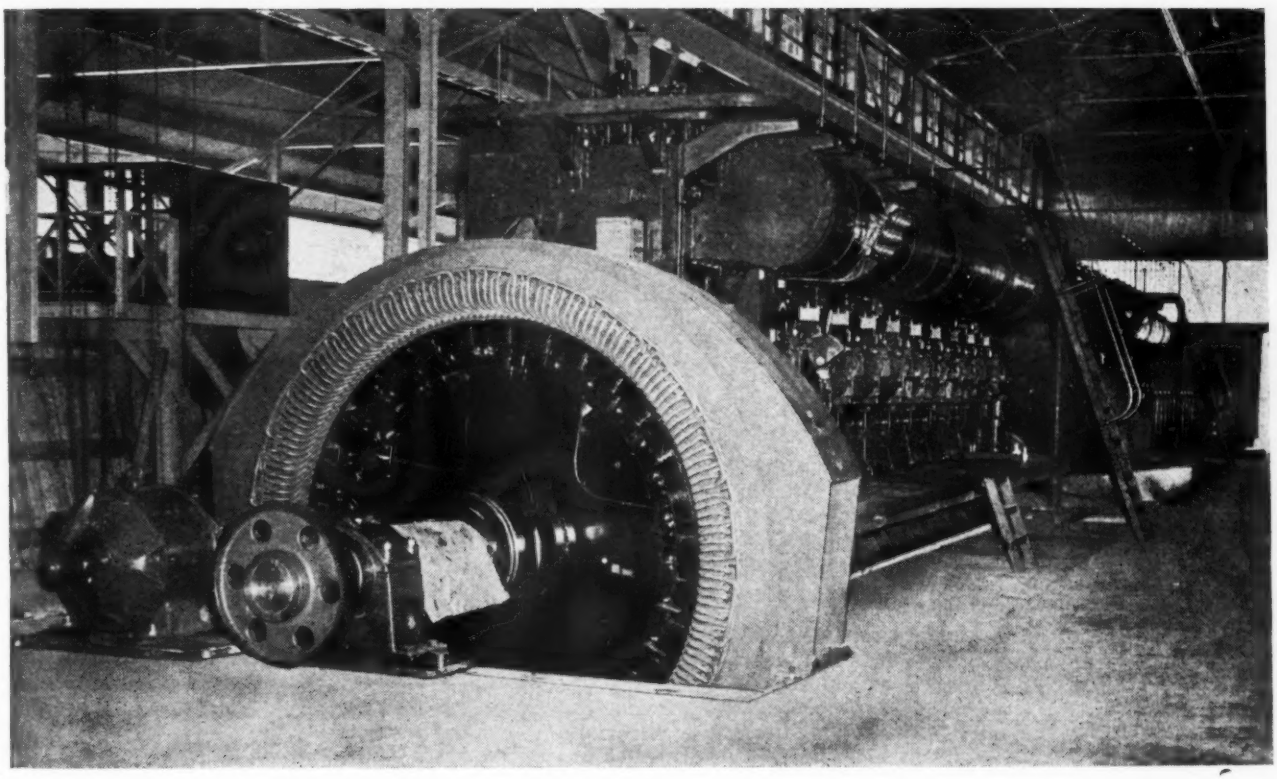
However, as indicated by the summary of a McGraw-Hill sampling of the current experience of industry in increasing output per man-hour, which appears in the center of the page, there is hope that the situation ahead can be improved. After agonizing delays because of work stoppages, material shortages, and reconversion complications, industrial production is beginning to roll again. Allowed to roll it will not be long before it will be making those advances in productivity which are the only true basis for increased "real" wages.

If the process of keeping American industry rolling to new highs of productivity is to be resumed, management must see that the past practice of translating increased output per man-hour into increased "real" wages is not only sustained but wherever possible accelerated. For its part organized labor must abandon its manifold feather bedding rules and other production-restricting practices which afflict considerable segments of American industry. Further it must give incentive systems of pay, honestly conceived and honestly administered, a fair break. *Management and labor and government and the community at large must collaborate in removing that specter of working one's self out of a job which has been one of the greatest causes of restriction of output.*

The current emphasis by leaders of organized labor on the economic truth that increased output per man-hour is the only road to increased "real" wages is important. The next step is to see that recognition of this truth seeps into the rank and file of labor and industry and becomes the basis of a program of action at the local level. If it does, and quickly, Labor Day, 1946, may mark a tremendous turning point toward sustained prosperity not only for labor but the community at large. If it does not, union leadership will fail in its responsibility and must answer to the American people for the consequences of such a failure.

President McGraw-Hill Publishing Company, Inc.

Large Diesels in Panama Canal Plants Unique for Automatic-Starting Scheme



Two of seven 3550-hp engines. Started automatically they come up to speed, then synchronize themselves with the line

Bought for the third set of locks and converted for wartime use, seven 3550-hp diesel engines in two plants are started by automatic devices, which replace each step that an operator performs. Assistant Editor John L King, who helped to install the engines, tells how the automatic system works

▶ As a safeguard against power failure in the third set of locks for the Panama Canal, diesel plants were selected for standby service. Since the entire lock operation is by remote control, the diesel power plants are designed for automatic starting when the operator calls for emergency power.

Because the third set of locks was designed for 60-cycle electrical equipment, the Panama Canal 25-cycle power had to be converted to 60 cycles before it could be used. This was done with a frequency changer located in the power plant at each lock location. To make the frequency changers perform with the engines in the remote operation, they also are designed for automatic starting.

In the original power-plant design the diesel engines, frequency changers and associated switchgear for each location in the third set of locks were laid out in one long room in the lock wall. Seven 3550-hp diesel engines and three frequency changers, two of 6000 kw and one of 3000 kw, were divided so three engines and one 6000 kw frequency changer were located in the Gatun or Atlantic locks, and two engines and one frequency changer in each of the two Pacific locks. Because of space limitations in the lock walls the power plants were laid out with engines end to end and the frequency changer at the end of the group—all in one long row; switchgear was along the wall beside the engines.

TEMPORARY LOCATION

The engines, frequency changers, switchgear and auxiliary equipment were ordered early in the third-locks program to supply temporary construction power because the existing Panama Canal power system was loaded to capacity. For convenience of design and construction, equipment was arranged in the temporary buildings in exactly the same order as designed to fit into the lock walls. Layout of the temporary Gatun plant is shown in Fig. 2.

In the temporary Pacific power plant, however, engines and frequency changer from both sets of locks are located in one building. It contains four engines and two frequency changers, plus switchgear for both plants.

Emergency Use. Before construction on the temporary power plants had progressed very far the third-lock project was cancelled because of the war. Power-plant construction, however, was continued so they could be used as emergency standby power sources for the then heavily overloaded Panama Canal system.

The temporary plants had to be built close to the construction work, and the location proved to be a good one for emergency plants also.

DIESEL ENGINES

The seven Busch Sulzer engines are identical units. Each is rated 3550 hp at 240 rpm. with 10% overload capacity for any two consecutive hours out of 24. The units are 10-cylinder 2-cycle, having a 20-in. bore and a 21-in. stroke. They are mounted on foundations that bring the operating platform about two feet above the floor. Lubricating- and cooling-system auxiliaries are in the basement. Intake-air filters and silencers and exhaust mufflers are mounted on the engine-room floor in a side bay on the back side of the engines, see Fig. 1.

Engines are direct connected to 11,500-v 2500-kw 0.7-pf 3-phase 60-cycle Westinghouse generators. The latter are 30-pole 240-rpm units, equipped with dripproof housings.

COOLING SYSTEM

The engine's cooling system consists of two circuits (1) soft water, which circulates in the engine cylinder jackets and (2) raw or salt water, which passes through the lubricating-oil and jacket-water heat exchangers in series. The soft-water system for each engine is kept full from a float tank mounted near the ceiling in the engine room, giving a static head of about 20 ft on the system. Two circulating pumps, one main and one auxiliary, keep the water circulating between each engine jacket and the heat exchanger. The Pacific plant draws raw water from a lake and pumps it up to plant level. In the Atlantic plant, the raw cooling water is circulated through a cooling tower. A thermostatically operated valve opens and closes a bypass around the soft-water side of the heat exchanger, thus regulating and maintaining constant temperature in the engine jackets. Lubricating-oil temperature is regulated by a thermostatic valve, which bypasses the raw water around the heat exchanger. All cooling-water piping and heat exchangers are necessarily large because average raw-water temperature is 84 F.

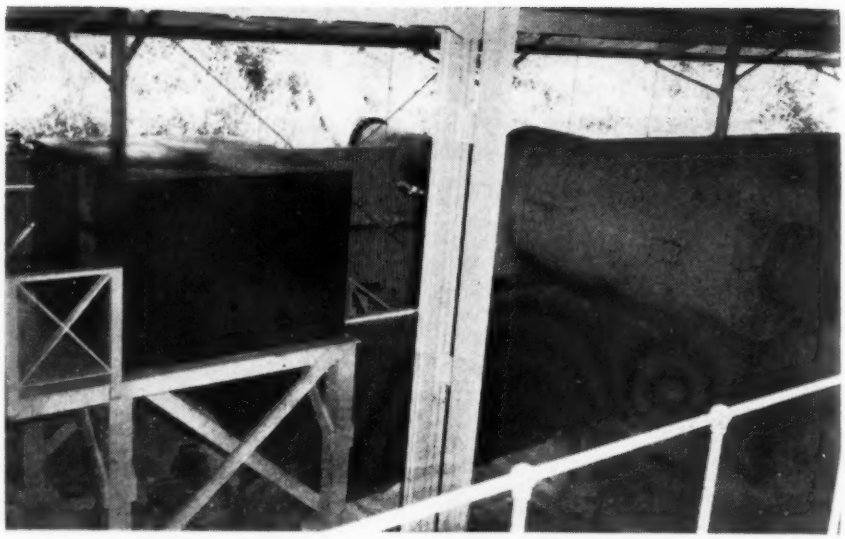


Fig. 1—Intake air cleaner and silencer, left and center. Intake filters, mounted above floor, avoid excess dirt and clogging. Exhaust muffler, right, mounted on a track with rollers to compensate for manifold expansion and contraction

Intake Air and Exhaust. Intake air is cleaned by passing through spun-glass filters. It then passes through muffler or silencer before entering the intake header. Four pressure blowers take the air from the intake header and raise the pressure to about 4 in. of water in the intake manifold. The exhaust passes from its manifold into a muffler, and then out the side of the building. Fig. 1 shows intake and exhaust mufflers.

Lubrication. A gear pump mounted on the front of the engine provides positive forced-feed lubrication. Oil is di-

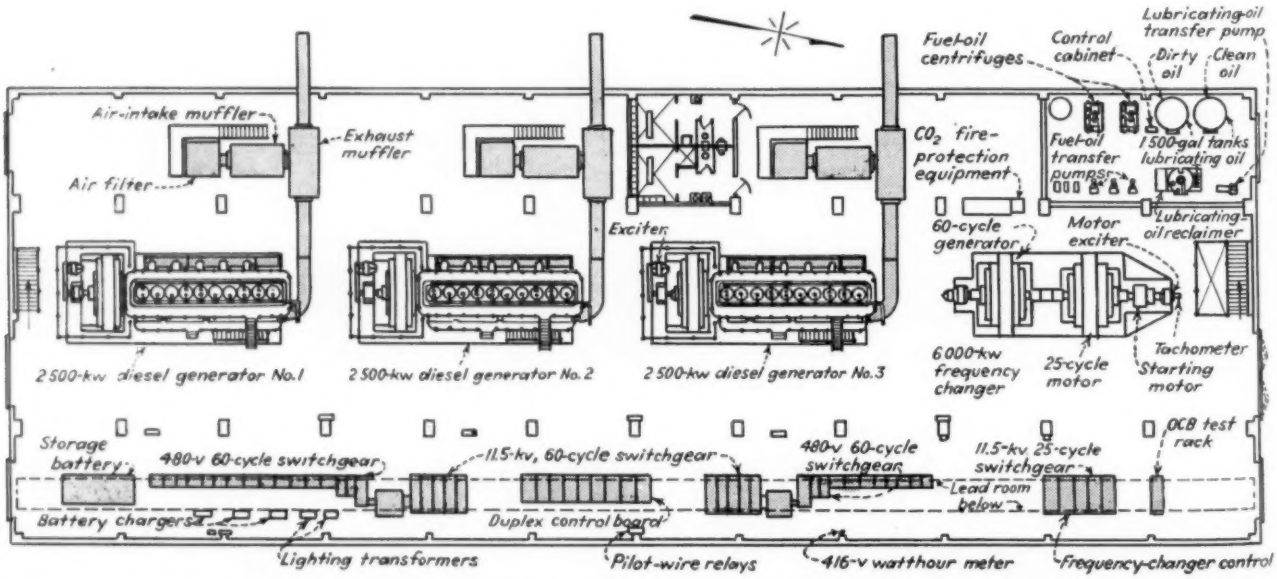


Fig. 2—Floor plan of Gatun power plant showing layout of equipment on the engine-room floor. Note how the engines and frequency changers are mounted end to end with the switchgear and auxiliaries mounted along each side

vided into two channels for (1) lubricating all moving parts, and (2) piston cooling. Oil passes from the storage tank to oil pump and through the heat exchanger before it reaches the engine. This procedure maintains a positive temperature control before the oil reaches the engine.

Cylinder lubrication comes from a forced-feed multicircuit lubricator. A special oil is used for this part of the system; therefore the return is diverted into a separate tank. After the cylinder-lubricating oil, which is used only once, passes through the reclaimer it is mixed with the main lubricating oil.

STARTING METHODS

Since records of automatic-starting methods for engines as large as these were unavailable, the basic problem was approached from the viewpoint of an operator getting ready to start an engine. Everything he checks by feel or observation had to be checked by a device that would withhold the start if conditions were not correct. After the engine was up to speed, all conditions which were normally checked by the operator again had to be checked by the device to see that everything was working satisfactorily. Fig. 3 shows a schematic diagram of the starting mechanism and the essential working parts for one cylinder.

Manual Start. To start the engine, control lever *A* is moved from stop position through the run to start position. This moves the fuel-control shaft to the position that calls for fuel. Fuel can be admitted to the cylinders because the governor calls for full fuel when the engine is shut down and governor flyballs are not rotating. When control lever reaches the starting position, a cam opens distributor-starting valve. Pilot air opens the starting-air header valve and also passes air to the starting-air distributor, which opens the proper starting valve and thus starts the engine rotating. Engine is rotated by air as long as the control lever is held in the starting position and starting-air distributor valve is open.

After the engine comes up to speed the operator pushes the engine control lever to running position. By this time the governor has taken control of fuel-control shaft and the engine is operating normally. Before leaving the engine the operator checks lubricating-oil pressure, water and oil temperatures and all other important operating details.

AUTOMATIC START

A remote-control switch initiates the automatic start by picking up a master relay. This relay checks the condition of all important parts of the engine through temperature and pressure switches and other devices. When conditions are found normal, the relay starts the 90-gpm lubricating-oil priming pump. Oil pressure builds up to 6 psi; then switch 63QP closes a circuit, which indicates that the engine is ready to start.

Master relay also energizes solenoid valve 20AF, which admits air to cylinder *O*. This cylinder must be raised while the engine is operating because

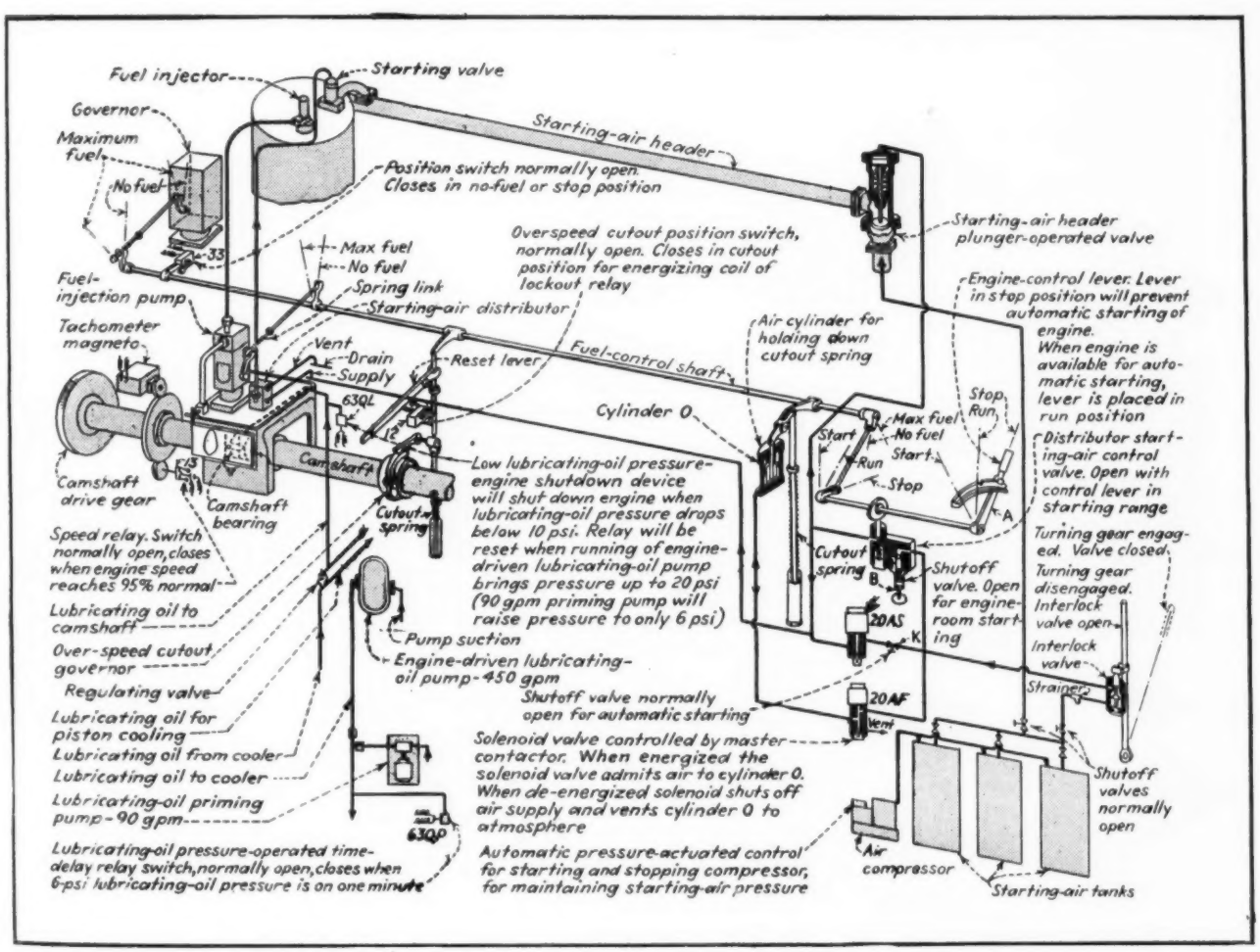

Fuel injector
Starting valve
Governor
Maximum fuel
No fuel
Starting-air header
Position switch normally open. Closes in no-fuel or stop position
Overspeed cutout position switch, normally open. Closes in cutout position for energizing coil of lockout relay
Starting-air header plunger-operated valve
Max fuel
No fuel
Spring link
Fuel-injection pump
Starting-air distributor
Engine-control lever. Lever in stop position will prevent automatic starting of engine. When engine is available for automatic starting, lever is placed in run position
Tachometer magneto
Vent
Drain
Supply
Reset lever
Fuel-control shaft
Air cylinder for holding down cutout spring
63QL
Cylinder O
Stop
Run
Start
Max fuel
No fuel
Distributor starting-air control valve. Open with control lever in starting range
Camshaft drive gear
Camshaft
Camshaft bearing
Cutout spring
Low lubricating-oil pressure-engine shutdown device will shut down engine when lubricating-oil pressure drops below 10 psi. Relay will be reset when running of engine-driven lubricating-oil pump brings pressure up to 20 psi (90 gpm priming pump will raise pressure to only 6 psi)
Turning gear engaged. Valve closed
Speed relay. Switch normally open, closes when engine speed reaches 95% normal
Cutout spring
Shutoff valve. Open for engine-room starting
Turning gear disengaged. Interlock valve open
Lubricating oil to camshaft
20AS
Interlock valve
Over-speed cutout governor
Pump suction
Engine-driven lubricating-oil pump-450 gpm
Regulating valve
Shutoff valve normally open for automatic starting
Strainer
20AF
Vent
Lubricating oil for piston cooling
Solenoid valve controlled by master contactor. When energized the solenoid valve admits air to cylinder O. When de-energized solenoid shuts off air supply and vents cylinder O to atmosphere
Lubricating oil from cooler
Lubricating oil to cooler
Shutoff valves normally open
Lubricating-oil priming pump-90 gpm
63QP
Lubricating-oil pressure-operated time-delay relay switch, normally open, closes when 6-psi lubricating-oil pressure is on one minute
Automatic pressure-actuated control for starting and stopping compressor, for maintaining starting-air pressure
Air compressor
Starting-air tanks

Fig. 3—Schematic diagram of the automatic starting mechanism shows all important working parts involved in duplicating the manual operation of starting the engine. Note how automatic equipment works in with standard equipment so that full benefit is derived from both. However, automatic devices always stop engine in emergencies

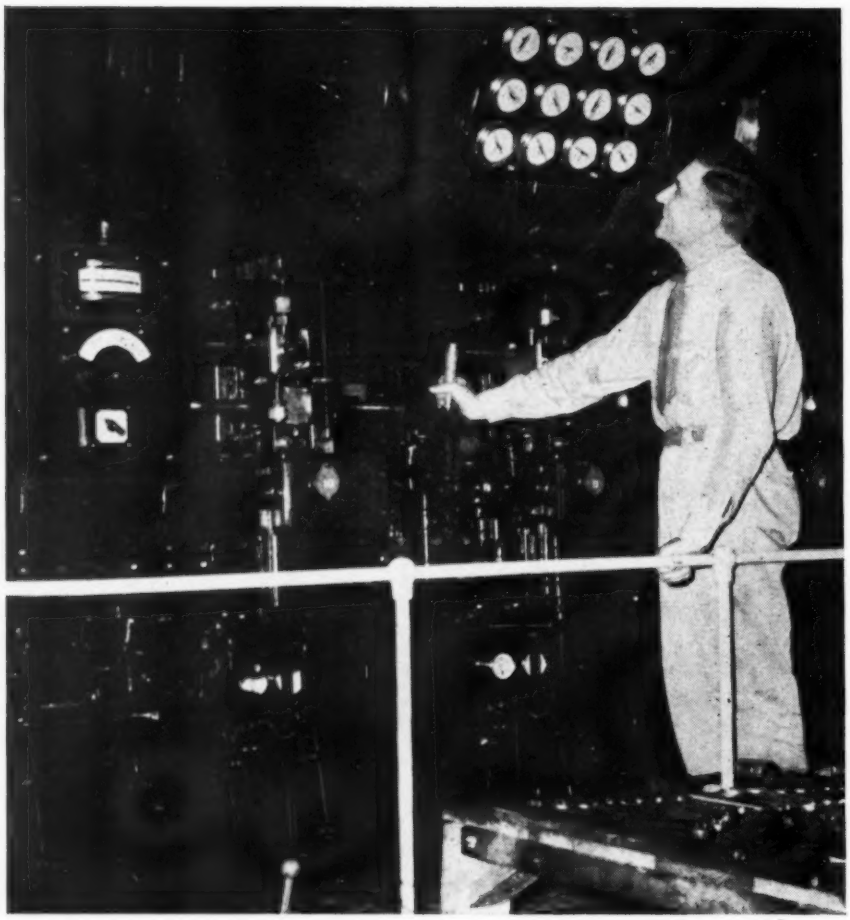


Fig. 4—C J Hartwein, Busch Sulzer erection engineer, checks engine performance after one of the trial automatic starts and finds everything satisfactory

it depresses the cutout spring that shuts the engine down by remote control or, in case of danger, as indicated by the automatic devices.

Pilot air is drawn from the starting-air tanks. It passes first through an interlock valve on the turning gear, and then to solenoid valve 20AS and 20AF for automatic starting and shutoff valve *B* for manual starting.

ENGINE-STARTING STEPS

The engine starts turning over when solenoid valve 20AS is energized, after the automatic devices have been checked and the oil pressure built up as indicated by pressure switch 63QP. The process of turning the engine over is exactly the same as manual starting; that is, pilot air is admitted to the starting-air distributor and header valve, which times and admits air to five of the ten cylinders.

After the engine has started and reached about 230 rpm, speed-switch 13 picks up and deenergizes valve 20AS and shuts off starting air, making it possible for pressure switch 63QL to stop the lubricating-oil priming pump. At this point the governor takes control of the engine and it operates normally.

To shut down the engine if the temperature goes too high, temperature relays are used to check (1) jacket-water temperature, for each cylinder and for the group, and (2) oil temperature at each piston-cooling discharge and other important points, such as generator bearings. Pressure switch 63QL on the lubricating-oil system also shuts the engine down if pressure drops below 10 psi.

Shutdown. The engine is shut down by closing solenoid valve 20AF, which vents air cylinder *O* and allows the cutout spring to move the fuel shaft into no-fuel position. This is done by master-control relay through the main control switch or one of the protective temperature or pressure devices.

Automatic devices are all arranged so they do not interfere with the normal operating characteristics of the engine. That is, the unit can be stopped at any time by moving the engine control lever to stop position. Overspeed device functions independently of automatic system. On the other hand, the automatic devices stop the engine whenever anything goes wrong.

Lock-Out Control. If any of the protective devices functions or stops the engine, a special lockout relay on the control board is opened and latched open. An annunciator and alarm indicates which device has stopped the engine. An operator must locate and remove the cause of the trouble, and then reset the lock-out relay by hand before the engine can restart either manually or automatically.

PERFORMANCE CORRECTED

After the engines and all control devices were installed and the connections completed, the automatic-starting system was thoroughly tested. It worked satisfactorily but one unforeseen condition resulted that was undesirable from the viewpoint of engine performance.

With the engine control lever in run position and the engine not running, the governor allows the fuel-control shaft to move into full-fuel position. Therefore, when the engine started firing it received heavy charges of oil, which caused it to accelerate rapidly. Sometimes it would come up to speed so fast it tripped off or overspeeded before the governor could regulate the speed. On each starting process the pressure-relief valves in the cylinders would relieve the excess pressure caused by firing the heavy charges of oil. Although these relief discharges cause no material damage they are extremely annoying because they occur with the noise of a violent explosion. This condition does not prevail on manual starting because the operator has control of the fuel shaft when the engine control lever is in start position. He can therefore regulate acceleration rate of the engine.

Acceleration Slowed. During automatic starting, acceleration was checked in a series of trial starts by moving the load-limit dial on the governor to zero. This keeps the fuel-control shaft from moving into full-fuel position. Although this method accomplishes the required results it was impossible to use it for remote automatic start because the load limit setting had to be at maximum; otherwise it was impossible to load the engine. A solenoid was therefore installed that moved the governor mechanism to the no-fuel position. Its restraining effect was removed by deenergizing the relay when the machine reached full speed and the speed switch picked up.

After this difficulty was corrected, the starting sequence gave no further trouble, and the machines were put into service and made ready for operation.

THE OPERATING ENGINEER

PRACTICAL AIDS · MAINTENANCE HINTS · QUESTIONS—ANSWERS

PUBLISHED MONTHLY AS AN INTEGRAL PART OF POWER

Adequate Routine Maintenance Keeps Hydroelectric Generators on the Job

Changes in stator air ducts and slot wedges improve machine ventilation, reduce operating temperature and extend insulation life. L B Stirling, superintendent, generating div of Shawinigan Water & Power Co, explains practices applicable to small and large plants, and gives tips on rebuilding units

▶ EVEN THOUGH HYDROELECTRIC GENERATORS are highly reliable machines when correctly designed, installed and operated, they require systematic inspection and maintenance to correct minor defects that might cause a major breakdown. Inspection and maintenance procedures suggested here are based on many years' experience operating one of the largest hydroelectric systems in Canada.

Release Unit From Service. To obtain release of a unit from service long enough for necessary inspections and repairs frequently presents a major difficulty in routine hydroelectric-plant maintenance of power-generating equipment. On a system like that of the Shawinigan Water & Power Co, on the St. Maurice River, Quebec, Canada, installed capacity does not greatly exceed normal, regulated river flow, and the market for secondary power is large.

As exact river flow and rainfall cannot be predicted for any appreciable period, it is difficult to schedule an extended generating-unit shutdown with reasonable certainty that it will not cause considerable revenue loss. Therefore the load dispatcher hesitates to allow a unit to be taken out of service when there is a possibility of water being available for additional power.

Most hydroelectric generators in Canada and the U. S. operate at moderate speeds and seldom have to meet space limitations. Consequently, they are liberally designed and operate for long periods with little maintenance. Recent developments in design and materials have improved them to where their reliability is comparable to that of transformers. This applies primarily to hydroelectric generators built within the last ten years. Earlier machines required more attention than modern ones to avoid untimely failures. Also, maintenance of older designs frequently may be extended to include partial modernization that reduces maintenance and improves reliability.

Ventilating Air. Insulation life depends on operating temperatures. For this reason, usual operating practice establishes upper temperature limits, which presumably will result in an economical insulation life. Because ventilating air is the chief means of removing heat generated in the machine, air flow through its windings and core ducts

At Grand' Mere power station on the St. Maurice River, Quebec, an 18,500-kw generator was rebuilt for 1600-kw more capacity, with temperature reduced 40 C

must be maintained at highest possible volume. Unless this is done permissible loading of the machine may have to be reduced to keep winding temperatures within safe limits.

With totally inclosed generators that have self-contained cooling systems, ventilating-air flow is not a serious problem. Machines with open ventilation, however, accumulate dirt on their windings and in their stator air ducts, which reduces air flow through them. Some early machines had bent duct spacers in their cores to give the stator rigidity. It was almost impossible to clean such ducts thoroughly.

Most modern generators have straight core-duct spacers and their air ducts generally can be cleaned by pushing a brush or rod through them from outside the stator. Some of the air ducts cannot be cleaned by this method because the stator frame is in the way. Therefore, for a thorough cleaning job remove the rotor or lift the stator so all air ducts can be reached.

Improving Ventilation. Removal of the rotor permits (1) a thorough cleaning and inspection job and (2) minor ventilating-system changes that may appreciably increase air flow. With two air-duct spacers in each core tooth, frequently there is a wide opening between spacers at the tooth center with two narrow ones between spacers and coil sides. Slightly increasing these openings by bending the two spacers toward each other increases air flow through the side ducts more than it is decreased through the center one. Also, the possibility of the side duct becoming blocked with dirt is greatly reduced.

When slot wedges have the same section for their full length, the beveled edges project beyond the coil sides into the ventilating ducts and restrict air flow from them. Cutting off the wedge edges in the ducts back to the coil sides, as at *A*, Fig. 1, appreciably increases ventilating air flow. Further air-flow improvement obtains if the wedge tops over each duct are tapered against the direction of rotation, as at *B*, Fig. 2. The taper's high sides face the direction of rotor rotation and tend to form an orifice between the rotor and tapered sides of the wedges. This gradually accelerates air flow from the ducts into the air gap with a resultant increase in volume.

A major improvement in ventilation can be obtained by installing recently developed air-slide wedges, in Fig. 6, on which one side projects slightly into the air gap, as at *C*, Fig. 3. This was done recently on one of two similar 40,000-kva machines. The machine equipped with the new wedges operates at 7 C lower temperature than its companion, which still has old-type slot wedges.

Lifting Stator or Rotor. Because of the possibility of damage to rotor or stator some operators hesitate to lift them unless necessary. Adequate hoisting equipment and competent supervision reduce this hazard to the vanishing point. Choice of lifting stator or rotor depends on the installation. With stator bottom at floor level it is probably easier to raise this part of the machine. When generator is elevated on concrete pedestals, it is generally necessary to lift the rotor.

Some operators prefer to remove several field poles to provide space to work on the stator. This appears to be practicable only when the pole wedges are designed to be readily removed. On most generators it may require more time to remove a few poles than to dismantle the machine.

Conductor Insulation. Vibration of conductors in their coils and of the coils in the stator-core slots, caused by normal magnetic-flux variations, is a common cause of coil-insulation failure. This vibration may cause strand wear and insulation failure in a coil, as in Fig. 6, and breakdown of coil insulation in the slot. Also, movement of loose core laminations will cut coil insulation and cause a breakdown.

Quality of conductor and coil in-

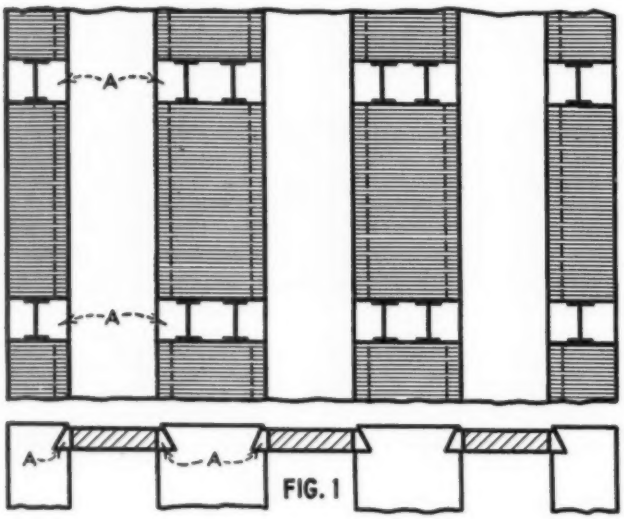
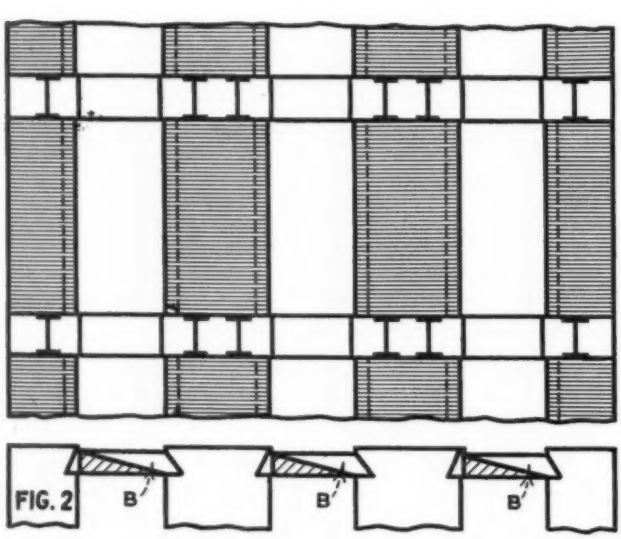
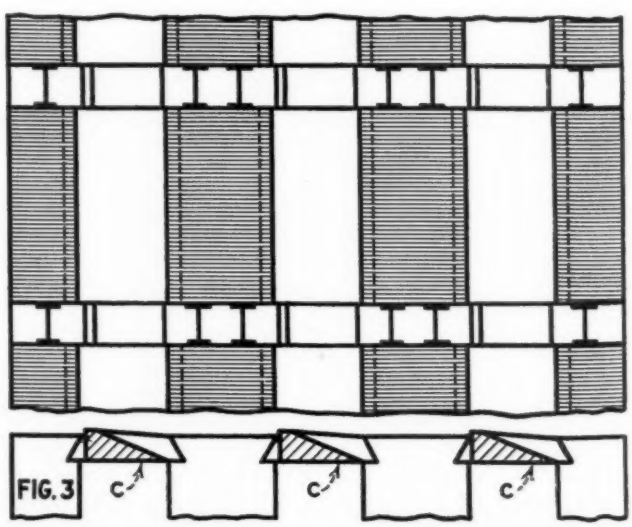
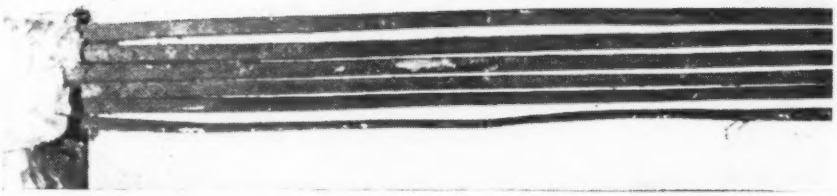


Fig. 1 — Wedges cutback in air-duct sections, A, improve ventilation. Fig. 2—For further ventilation improvement taper the slot wedges in duct sections, B. Fig. 3 — Air-slide wedges with cross-section, C, in air ducts further improve machine ventilation







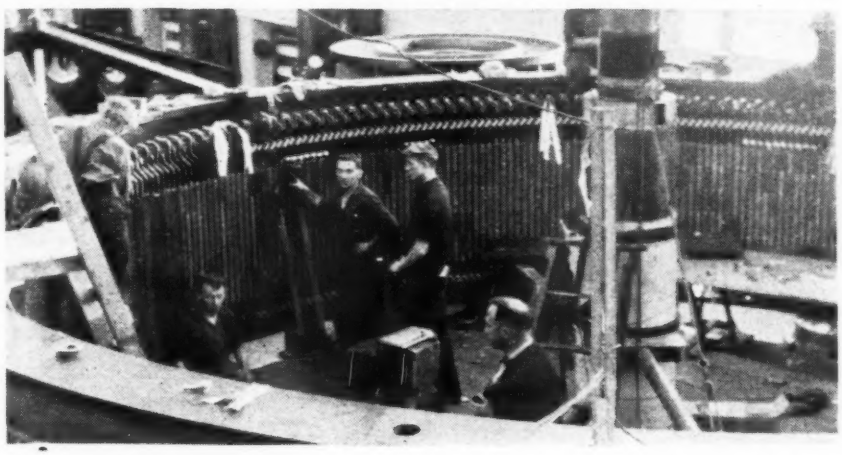


Fig. 4—Vibration of conductors in their coils and of coils in the stator-core slots causes coil strand wear and insulation failure, as in the photo at the top. Fig. 5—Rewinding an 18,500-kw generator after a mechanical failure caused serious damage to its stator winding and iron in the Grand' Mere power station

sulation and rigidity of conductors in a coil are determined by care in coil design and manufacture. It is generally impossible to check these conditions without removing a coil and opening its cell and turn insulation. This is not practicable as routine inspection, but whenever a coil is removed, carefully check its insulation and the condition of its conductors. If these show signs of weakening rewind the machine to prevent failure at an inconvenient time.

Avoid coils becoming slack in their slots and loose stator laminations when assembling the machine. These conditions may not become evident until after a unit has been in service for some time. Generally they can be detected by careful examination of the stator, and corrected without an extensive dismantling job on the machine.

Coil and Core Insulation. Removal of a few slot wedges permits inspection of coil fit in slots. If slackness exists it can be corrected by adding packing under the wedges. Loose stator laminations are not so easily detected. However, clamping bolts generally can be checked and any slack nuts tightened. On some machines tooth-clamping-fingers and plates are separate. In such cases check each finger for possible displacement.

Coil end turns may be distorted by heavy fault currents. Any movement of the turns may break coil insulation at the slot ends. At these locations, end the coil insulation in a long taper so turn insulation can be well overlapped, but under any conditions keep end-turn bracing tight. Spacing blocks must fit snugly and give ample support to the end turns without seriously impeding cooling-air circulation. Glass-fiber cord has replaced hard twine for fastening the spacing blocks on some machines, but it does not appear to have any advantage over the twine except that it is fire resistant.

Repainting End Turns. Some operators repaint stator-winding end turns with insulating varnish after each annual cleaning. This practice may help maintain coil-insulation quality, but in several years a thick coat of varnish builds up on the coils that reduces heat dissipation and accelerates deterioration of turn and strand insulation. There appears to be no good reason for revarnishing the end turns as long as the original coat remains in a satisfactory condition.

None of the mechanical parts of hydroelectric generators requires frequent attention so maintenance is quite simple. Lubrication is generally ample. With relatively low bearing pressures and temperatures, oil of good quality and characteristics has long life. In some locations cooling-water solids deposit in oil-cooling coils or in air coolers. These deposits are removed by flushing the coils with any one of several available solvent solutions. Repair lubricating-oil leaks promptly, particularly on vertical units or the windings may become oil soaked, which impairs their insulation and creates a serious fire hazard.

Rebuilding Generators. Improvements in materials and design make possible greater output today from a generator of given size and speed than 25 years ago. Many of these improvements can be incorporated in old machines, so that frequently it is advisable to consider rebuilding when they require major overhaul.

A few years ago a mechanical failure caused serious damage to the field poles, stator winding and iron of an 18,500-kw generator. Because the turbine on this unit had some excess capacity, the generator manufacturer was asked to submit a proposal to rebuild the generator for greater output. This machine was rebuilt with new stator iron and coils, a new circuit arrangement, new field poles and more efficient ventilating fans. It now delivers 1600 kw more than before rebuilding and operates at 10 C lower temperature.

Useful life of generator insulation is now limited by the bonding material in the insulation. Bonding-material life depends on the machine's average operating temperature, and its power output is accordingly limited to a value that insures reasonable length of service before reinsulating the machine. The new silicone compounds offer possibilities of removing these temperature limitations. We therefore may soon hope to obtain generators that can operate permanently at relatively higher temperatures without danger of rapid insulation deterioration.

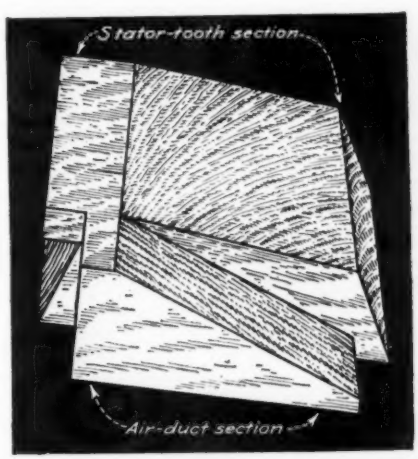
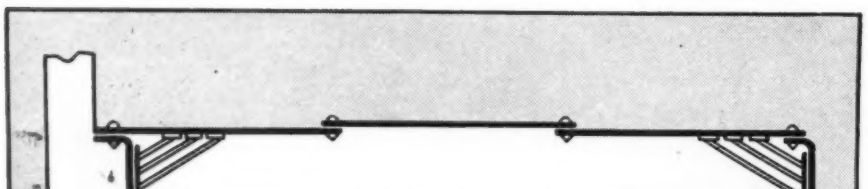


Fig. 6—Section of air-slide wedge, top of which projects into the air gap

PRACTICAL AIDS TO OPERATION

Plant-Tested Methods and Ideas for Power Men



HEATING STRAIGHTENS BOILER STAYBOLTS

OUR PLANT has four hrt boilers 72 in. in diameter by 18 ft long. Each boiler has two through staybolts in its bottom, one on each side of the manhole. These stays bowed up to where they touched the bottom row of tubes, as indicated by dotted lines in the diagram. This was probably caused by forcing the boilers when burning coal during their first years of operation.

On taking charge of the plant I consulted the boiler insurance inspectors about having the stays straightened. They did not consider this necessary. During recent years we have been burning oil and have had trouble with girth seams leaking. To give the boiler the benefit of any doubt about the bowed staybolts I decided to have them straightened.

To straighten the stays in two of the boilers the boilermaker slacked off on the nuts inside and outside of the boiler and the staybolts straightened themselves, as they were under compression when bowed up. It was not necessary to remove the stays as is usual practice, but we had trouble getting the nuts leakproof tight again.

In the other two boilers the boilermaker heated the staybolt with an acetylene torch almost to a white heat for about 18 in. at approximately 4 ft from the front end. With small jacks he then forced the stays down by upsetting their heated sections so that when cooled they were in tension instead of compression. Two or three heats were required to do the job.

The boilers have been in operation for about one year since the straightening job was done, and all staybolts have remained straight. Heating the staybolts has proved successful and is probably better than loosening and tightening the nuts, which may be quite a chore.

Boston, Mass. C R KINNEY

Solvent Well In Work Bench Cleans Wrenches and Parts

A SHOP PRACTICE that speeds overhaul and pipe-fitting work on oily and dirty fittings is contained in the small tool-rest table or work bench shown in the photo. Constructed by welding used pipe and sheet iron, the table has at one end a rectangular well about 8 in. deep, which is kept partly filled with grease solvent.

Each time a dirty tool is laid down on the bench it is placed in the solvent. By the time it is to be used again the dirt has at least softened enough to be removed easily. Fittings also may be cleaned with the solvent in the well. Built like a drain board, the upper end of the table drains into the solvent well. To prevent tools sliding off the table pan, it is welded to the bottom side of the rectangular pipe framework, making a protected inclosure.

When many fittings or bolts are being worked on, duplicate sets of tools are used so that while one is being cleaned

a clean set is in use. This practice increases the mechanics' efficiency and reduces possibilities of injuries caused by gummed-up tools slipping.

Pomona, Calif. G M WILSON

Have Blowdown Tanks Properly Installed

A BLOWDOWN TANK between the boilers and the drain system is often necessary and is required by many cities and towns. The following outline presents some safe practices for this important installation:

1. Have tank of adequate capacity to hold all water that might be blown into it during normal operation. It is better

to have a tank a little too large than too small. General rule: Select a tank having one fifth the capacity of the boiler or boilers that might be blown down simultaneously.

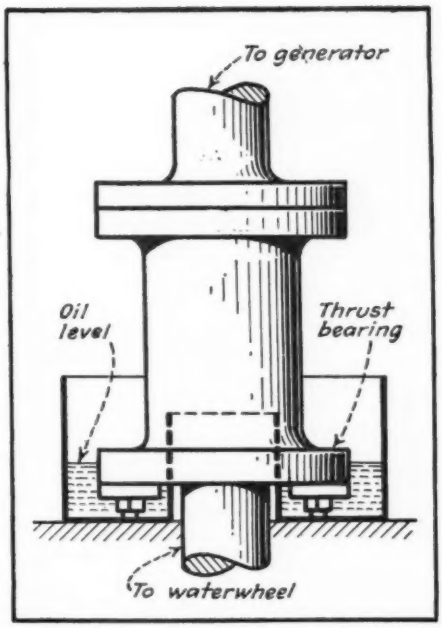
2. If the tank is not vented to atmosphere, it should be constructed for a pressure at least equal to that allowed on any boilers connected to the tank. Or, protect the tank with a safety valve set at not over the pressure for which the tank was constructed. New York boiler rules require $\frac{3}{8}$-in. minimum plate thickness. Provide a manhole or access opening to permit cleaning and internal inspection. Always comply with local ordinances.

3. If the blowdown tank is not protected, as under item No. 2, vent the tank to atmosphere with an open pipe at least twice the blowdown pipe's size. Shutoff valves are not permitted in the vent pipe. It must be adequately supported and discharge at least 7 ft. above any flat roof, runway or any place where a person might be passing. A baffle plate is usually desirable between the vent inlet and the blowdown discharge.

4. Provide a drain pipe at least twice the size of the blowdown pipe and extend it into the tank to within 6 in. of the bottom.

5. Blowdown piping, valves and fittings must meet all code requirements for the pressure and service. Avoid unnecessary bends and sharp turns. Freedom of expansion with proper support is necessary.

Canton, Mass. HARRY M SPRING



Centrifugal Force Spoils Thrust-Bearing Lubrication

AFTER ERECTING a large vertical-shaft hydroelectric unit we had trouble with the thrust bearing burning out. The unit, one of the largest built up to that time, had a revolving element that weighed 270 tons. This load along with the hydraulic thrust was taken by a thrust bearing below the generator. The bearing's upper plate was machined on a spool-like member, secured to the top end of the turbine's shaft, as in the diagram. On the spool's upper end the 5-ft flange matched the one forged on the generator shaft.

The flange at the spool's bottom rested on the thrust bearing's pivoted shoes, as shown. When ready for service the bearing was filled with oil to about 2-in. above the pivoted shoes. Every precaution had been taken to insure a good thrust-bearing job and at its slow operating speed, less than 60 rpm, no trouble was expected. After starting the unit, oil temperature gradually increased for about 16 hr and then the bearing suddenly gave up and failed.

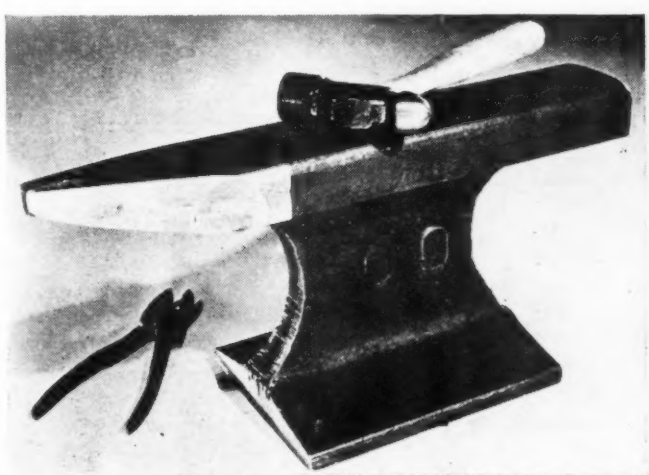
Two weeks' work was needed to install a new bearing, which failed the same as the first and as did others. Then the cause of the trouble dawned on one of the engineers. Centrifugal action of the revolving thrust plate, 5 ft in diameter, caused the oil to pile up around the bearing chamber's outer edge and leave the thrust shoes so poorly lubricated that they could not take the load. To aggravate this condition the vertical drain that determined oil depth in the bearing was near the outer edge of the oil container. When the oil was thrown out by centrifugal force to the container's side it drained from the bearing. Increasing the length of the drain pipe 2 in. corrected the trouble as the longer pipe maintained sufficient oil to lubricate the bearing properly at full speed.

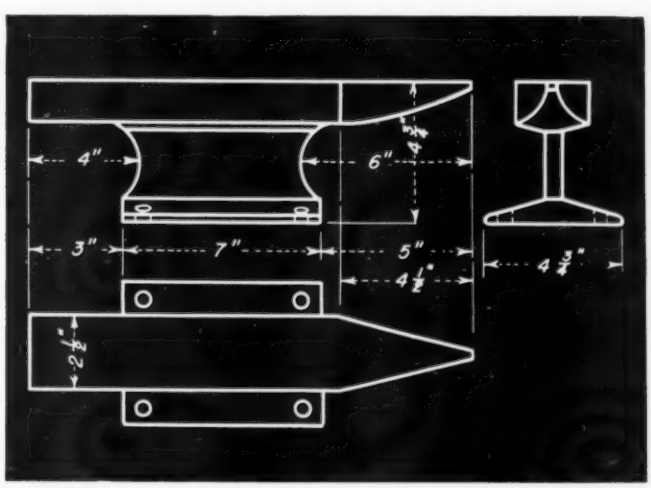
Cincinnati, O. H B MCDERMID

SMALL SHOP ANVIL CUT FROM SCRAP RAIL

ANY WELDING AND CUTTING operator can make a service anvil from a short piece of scrap railroad rail. All he needs is a cutting blowpipe and a steady hand—the steadier his hand the neater the job. The anvil in the photo was cut from a 15-in. length of 90-lb rail. Grinding or other finishing was not necessary to complete the job. Four holes were drilled in the base for attaching the anvil to a solid support. If a drill is not available the holes can be pierced with the blowpipe.

The drawing gives recommended dimensions for most light work. They can



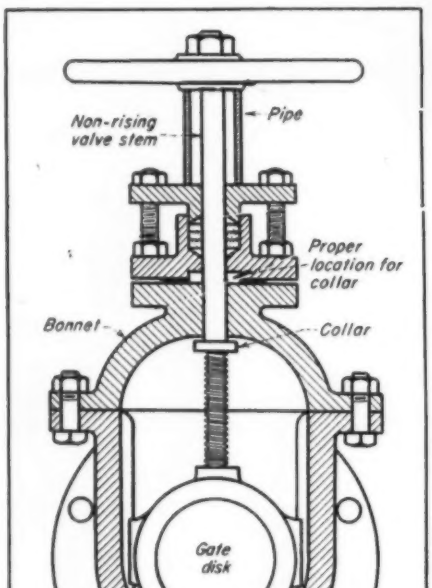


be altered to suit individual requirements or a piece of heavier rail can be used if desired. If a conventional round horn is required on the anvil it can be roughed out with the blowpipe by making tapering cut to the taper's base. Excess metal is then ground off to round the horn.

Vernon, Texas CHARLES S WHITE

Improper Assembly Prevents Valve Opening

A RECENT EXPERIENCE with a nonrising-stem gate valve taught us the need for close inspection of overhauled valves before installation. The valve had been in service some time without being closed. We then closed it to make repairs to the piping on its downstream side. When we attempted to open the valve we found that instead of lifting the disk the stem screwed down into the valve. It was

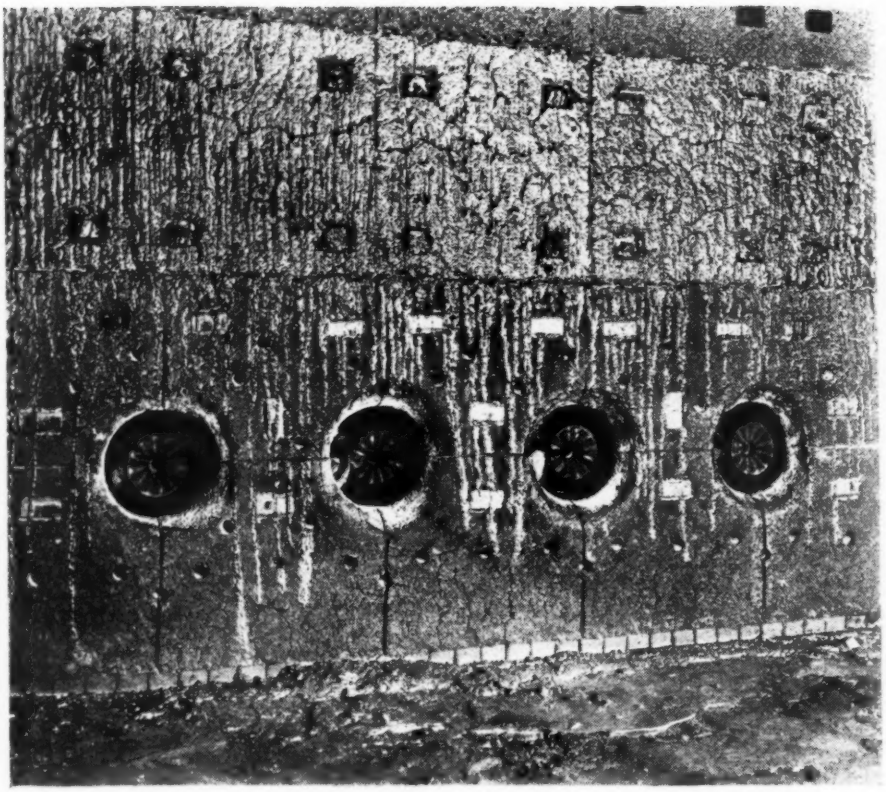


impossible to remove the valve because the main pipeline could not be shut down.

We surmised that the valve had been assembled with the stem's collar under its bonnet, as in the figure, instead of above. To open the valve we turned the handwheel in the opening direction, which brought the stem up as far as it would go. We then cut a section of piping, with an inside diameter larger than the stem, just long enough to fit in between the handwheel and packing gland. Removing the handwheel, we put the pipe on the stem and tightened the wheel in place again. This pipe spacer took the thrust required to open the valve. Later when the valve was opened for repair it was found improperly assembled, as suspected.

DEAN H BERGMAN

Bellingham, Wash.



CONICAL HOLES AIR-COOL FURNACE WALL

THE FRONT WALL of the furnace in our boilers used to burn away at regular intervals of about four months. Side and back walls were air-cooled with hollow-tile ducts but the burners kept us from using this system in the front wall. After rebuilding the front wall several times we tried an air-cooling scheme that preserves the refractory in the front wall and makes it last as long as the others. We moulded a group of conical holes through the brick wall. The holes, about $\frac{3}{8}$ in. diameter at the outside surface, enlarge to 3 in. on the inside. They are grouped around the burners to cool the brickwork where it previously failed. The photo shows the front wall's appearance after one year's operation.

Note how the surface above the cooled sections has melted and run down. The wall is in good shape and can easily be used another year at least before it will require repairing.

Worcester, Mass. C J LLOYD

Insulation Tests May Be Misleading

A MAGNETO is frequently used for testing electrical equipment and circuits. It is an old standby but must be used with an understanding of its limitations. The magneto generates ac and therefore may give different results than when dc is used to make the same test. A friend of mine complained that on tests his magneto would show an open circuit when further investigation showed the circuit complete. At other times the magneto indicated a dead ground on an insulated circuit. These results confused him badly.

Such results can be obtained on inductive circuits and large motor or generator windings when they are in good condition. If a magneto is used to test through a field coil when it is on a pole-piece, inductance of the coil may keep the current below a value sufficient to ring the magneto's bell. When the same coil is tested with dc it may show the coil to

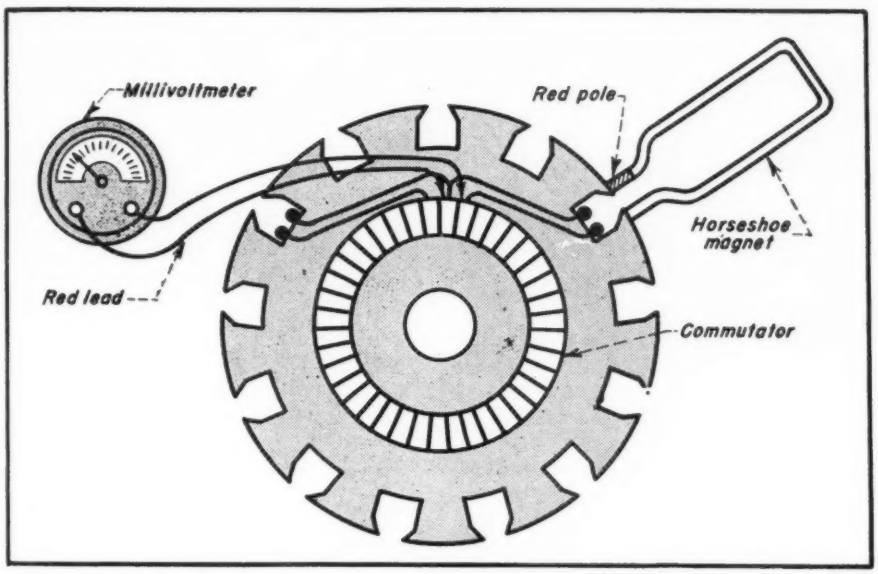
be in as good condition as when first installed.

The answer is that the ac of the magneto induces a counter-voltage in the coil almost equal to the applied voltage from the magneto. Consequently current flow in the winding is kept to a very low value. When dc is used inductance exists only momentarily when the circuit is closed or opened and the current soon reaches a value determined by the applied voltage and the circuit resistance.

When the magneto is connected between the winding and frame of a large machine the winding acts as a condenser. This condenser may conduct sufficient current to ring the magneto's bell, indicating a ground when the winding insulation is in good condition.

If a little care is taken when applying a magneto test it is fairly reliable. However, when insulation is being tested an insulation megohm meter should be used as it gives the insulation resistance directly in megohms. Since these devices have a dc generator they give correct results where a magneto's indications may be misleading.

Chicago, Ill. J B MULLINS



TESTS FOR REVERSE-CONNECTED COILS

SOMETIMES DC MOTOR or generator armatures require testing for reverse coils. A common method of doing this is to place a compass over an armature slot, energize the coil, and note the deflection of the compass. Perform this operation for each coil all the way around the armature. When coils are promptly connected the compass deflects in the same direction over all slots. A reversed coil gives a reverse deflection on the compass.

Method shown in the figure is more accurate and reliable than a compass. I use a horseshoe magnet; one from an old watthour meter serves nicely. To take the readings I use a millivoltmeter, an ammeter without a shunt. But a galvanometer or an ohmmeter may be used. Mark one magnet pole and one meter lead so they can be easily identified; for instance, paint them red.

To make the test, place the magnet across one slot with the red pole on the left, as in the diagram. If the location of the leads from the coil in this slot can be located on the commutator bars, place the meter leads on the two bars, with the red lead on the left. Pull magnet away from slot and note the deflection.

The needle should deflect in one direction if its leads connect to the proper commutator bars. If the meter does not deflect, move the magnet one slot to the right or left until a proper deflection is obtained when the magnet is pulled away from the slot. Mark the two commutator bars and the slot where the test was made. Then continue around the armature and test each coil.

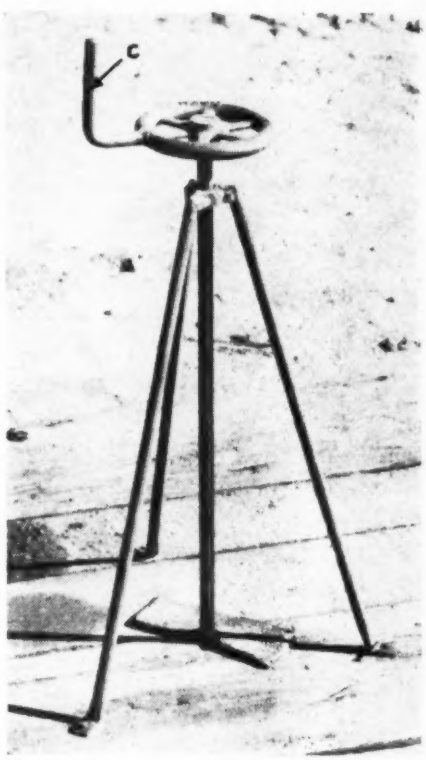
If there are no reversed coils the meter should deflect in the same direction each time the magnet is pulled away from a slot. A reversed coil causes the meter needle to give a reverse movement when the magnet is pulled away from the slot. When there are two coils in a slot move the magnet away from the slot to take a reading of one coil. Then shift the meter leads one commutator bar and pull the magnet away again to obtain a reading from the other coil.

Monmouth, N. J. HENRY KLEIBER

Valve Stem Extended For Emergency Closing

WHERE ALL FIRES might have to be extinguished at a moment's notice in a plant handling explosive vapors, one company installed an easily seen and manipulated extension on the main natural-gas valve in the fuel line to the boiler plant. The handwheel was removed from this valve and a 4-ft vertical extension welded to its stem. This brought the stem well above the platform over the trench in which the valve was installed.

After welding a crank extension, *C*, to the handwheel it was installed on the valve-steam extension as in the photo.



To give the long valve stem stability a 3-legged support was made from ¾-in. pipe flattened at the ends. The lower ends formed feet that were attached by lag screws to the planking floor. At their top ends the pipes are welded to a collar that fits loosely around the valve-stem extension. Painted a bright red for quick recognition, the hand-high valve wheel provides an inexpensive emergency valve-closing device.

Pomona, Calif. G M WILSON

READER'S PROBLEMS

Exercise your engineering wits by submitting answers to these questions fresh from the plant. Suitable material will be paid for; answers accompanied by sketches or photographs command additional pay

1—Why Do Rotor Bars Break in 30-Hp Motor?

WE HAVE a motor-driven coal-loading machine that walks around on caterpillar tracks. We use it out in the storage yard to load and handle coal that is stored or moved into the plant. The loader is driven by a 30-hp 3-phase 440-v squirrel-cage induction motor. Load on the machine varies considerably when it operates because it slows down and speeds up as it bites into the coal pile.

About six months ago the motor started giving trouble so we removed it for investigation. Our inspection revealed that several of the bars through the rotor slots were broken. After these were replaced the machine was put back in service. In about two weeks the same condition was again observed and as before several rotor bars were broken. The motor, which has just been repaired for the third time, reveals several new bars broken as well as some additional old rotor bars.

We want to find out what is causing this trouble. Will POWER readers tell us what is breaking the rotor bars? What can we do to correct this troublesome maintenance problem, and why did the motor operate several years without acting up?—*FLB*

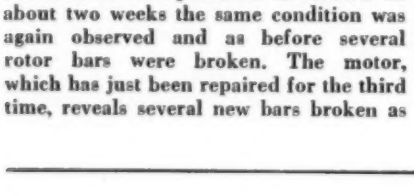
2—What Is Cause of Compressed-Air Explosion?

WE OPERATE three 500-cfm air compressors. Even though we have had no trouble we believe that explosions have occurred, which might have had serious results, in air receivers and other parts of the air systems. We think we do a pretty good job in operating these machines safely, but as a precaution I would appreciate suggestions from POWER readers on how best to guard against compressed-air explosions and fires.

We have been told that leaky discharge valves are a common cause of compressed-air explosions. If they are, what is the reason? It does not seen possible that recompression of air would produce high enough temperature to ignite oil vapors or other combustible material that might be in the air before it is compressed. —*SHC*

Editor's Note: *Every month several good answers cannot be published because they arrive too late to meet the deadline.*

Give your answer a chance; be prompt with your reply. All answers that reach us before the 22nd of September will receive consideration for the next issue. Let yours be among them.



What Is Best Way to Remove Motor Coils?

(This is Question 1 from the July issue, with best answers from readers)

I would like a simple, quick method of removing old burned-out coils from armature and stator slots. We have tried burning off the insulation but with modern types of insulation this doesn't work very well. So far we have used hand labor but would like to know whether some kind of machine or device has been found that saves time.

I also want to know a good method for cleaning the old insulation and varnish from the slots. Again we experimented by using acid but it didn't work at all satisfactorily. Can POWER *readers suggest some practical ways to perform these operations without purchasing a lot of equipment?—HEG*

Removing Coils Is Mostly Hard Work

REMOVING OLD, BURNED-OUT COILS, insulation and varnish from motor slots requires mostly elbow grease. Sizes of armature and stator govern the amount of work needed.

A chisel similar to a cape chisel with an edge just wide enough to get under the wedges will break them out easily. Cut the windings close to the slot at one end, and then cut winding at other end, leaving sufficient space to grasp the coils with a pair of pliers. By pulling on only one wire at a time a start can be made that loosens the coil. After two or three wires are pulled the rest of the coil can usually be pulled.

In larger-sized motors, windings are heavier and require more force. The same procedure is followed as in smaller machines, but pulling may have to be done with the assistance of a small block and tackle or chain fall.

When windings are removed from the slots it is necessary to remove old insulation and varnish. I suggest *HEG* purchase a suitable motor-driven wire brush with a flexible drive to fit his needs. He can keep a stock of brushes to fit different jobs.

The only other method of cleaning these slots is by hand, and that's neither easy nor quick. Scraping and chiseling out the insulation and varnish with tools made to fit the various-sized slots does the best job. Sometimes the coils can be driven out with a tool shaped to fit the slot.

E O'BRIEN
Springfield Gardens, N. Y.

Vapor Cleaning Removes Oil, Grease and Varnish

AS HEG HAS NO DOUBT found out, it is impossible to burn off Class B insulation, which consists of mica glass and other inorganic materials. Even Class A insulation should not be burned because heat distorts the iron lamina-

tions and ruins insulating varnish between them.

Several electric-driven portable tools are available for stripping armatures. One tool effectively drives out the wedges; another, a high-speed portable saw, cuts off the end turns of coils. Care must be taken with the cutting tool where surge rings are used on the motor because the saw may cut into them and do considerable damage.

To expedite removal of old coils and clean grease, oil, dirt and varnish from laminations and slots, *HEG* can use hot-vapor cleaning. This process makes use of a tank heated by steam or electricity. The bottom is filled with a cleaning solution such as trichlorethylene to a depth of a few inches. A cooling coil is installed inside the tank along the sides and near the top. Cleaning solution is heated to 180-190 F, where it vaporizes and causes a fog inside tank. When an old armature is lowered into this fog, vapor condenses on it, thus dissolving grease and oil and softens varnish. After this treatment old coils will practically fall out of the slots, and a wire brush will remove any loose varnish or dirt not carried away by the cleaning solution.

Tenafly, N. J. K B HOFFMAN

Homemade Stripper That Works Wonders

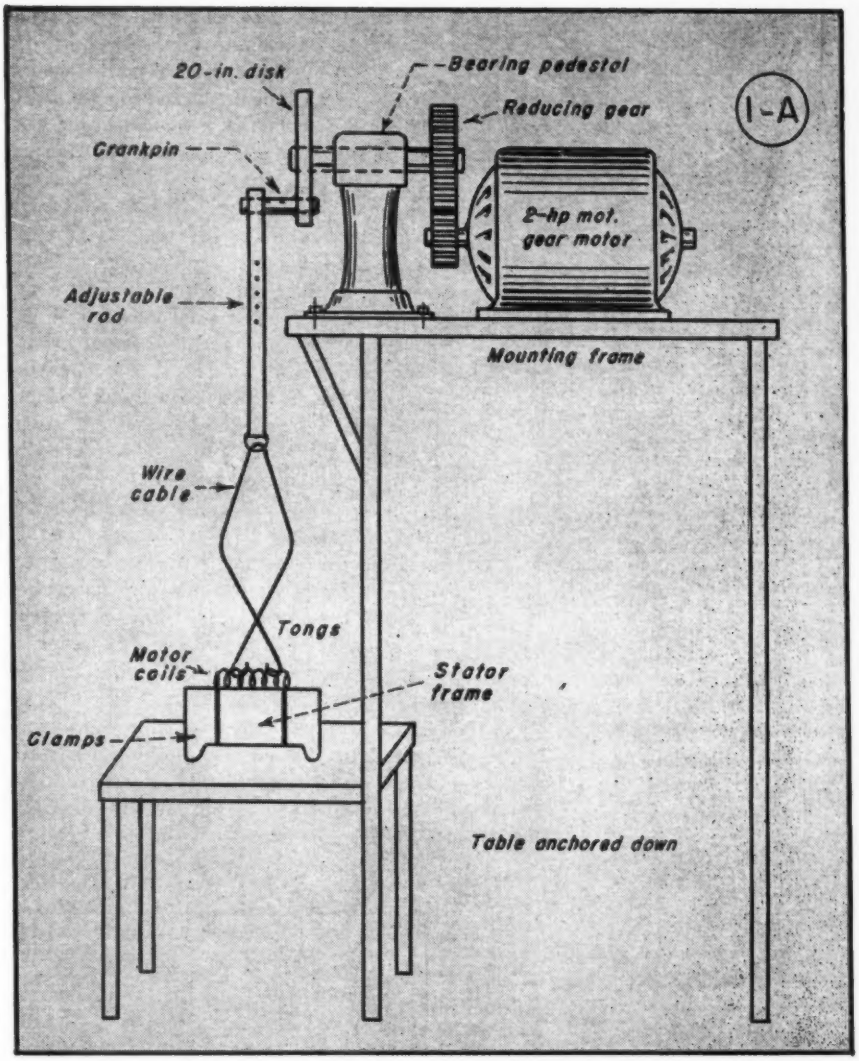
AFTER CONNECTION DATA are obtained from motor, cut the coils on one side of stator. Use a sharp chisel or air hammer. After coils are cut turn stator over and clamp it on the table as in sketch 1-*A*; it is then ready for stripping. The operator has a treadle switch on the floor so both hands are free while he operates the motor. He places tongs on coil to be removed, then presses button. Motor turns disk that works on crank action and lifts coils out of stator. Tongs will drop back to lowest point, ready to repeat the action. This is quite a timesaver involving very little cost. After coils are stripped out the old insulation can be cleaned out by conventional methods.

H W ENGELMANN

North Bergen, N. J.

Armature Coils Are Easy to Remove

IN REMOVING motor armature coils, first operation is to remove the banding wires. If these are cut with a chisel be careful not to dent the laminations. Unsolder the commutator leads, then remove slot wedges with steel drift of same size as wedge. Remove coils by raising the top sides for a distance of the throw so bottom side of each coil can be reached. Using care not to disturb their shape, take out several coils to serve as a guide in forming new coils.



After all coils have been removed slots should be cleaned of old insulation by burning with a torch. Smooth any burs or rough places with a file.

Oaklyn, N. J. C WILKES

How Can I Reclaim Flyash for Burning?

(This is Question 2 from the July issue, with best answers from readers)

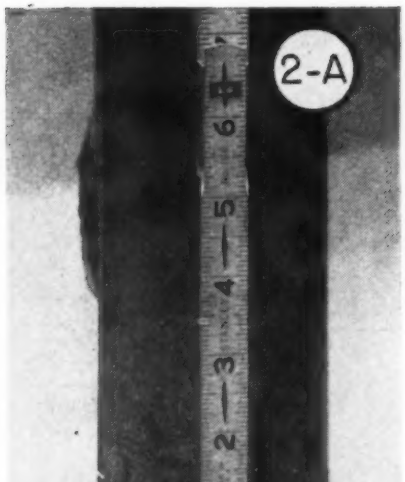
We have a spreader stoker in our hrt boiler. It was originally installed to relieve hand firing. The stoker works satisfactorily but we would like to reclaim some of the flyash. The breeching from the boiler connects near the base of the chimney. Excess flyash requires more clean-out at the chimney base than we used to have. I have noticed that flyash consists mostly of black coal particles that would burn if returned to the firebox.

Have POWER *readers ever seen this done? If so what would be a good method of removing flyash from chimney base and forcing it into the firebox where a forced draft is used?—LBN*

Wire Mesh Will Do the Trick

A PRECIPITATOR WOULD SOLVE *LBN's* problem of saving flyash and recovering unburned coal, but it is doubtful whether savings from such equipment would justify the cost.

A simpler method, and one that has worked well for us, is to install a thick wire mesh in the exit gas duct. We did this in our plant to prevent large particles of burning wood from passing



through the duct and out the stack. Our boiler burns refuse consisting of bark and sawdust. Gas duct is about 30x30 in. We placed the wire screen directly behind the air preheater. Wire used is 3/16 in. with 3/8-in. square mesh.

If wire mesh is used, size would naturally depend on size of flyash to be recovered. If the coal particles to be recovered are small, he will have to use a smaller screen.

It would also be well for *LBN* to check the baffling of his boiler before he starts to recover lost coal particles as any appreciable quantity passing through indicates poor baffling. He might also cut the furnace draft somewhat to prevent coal rising up through the passages.

Dolbeau, Que. R A LANE

Dust Burner Reclaims Flyash Combustible

IT IS RATHER a paradox to find the question "How Can I Reclaim Flyash for Burning?" printed directly above readers' replies to the question "What Causes These Boiler Tubes to Erode?" I am going to reply to the two together since they have a peculiar relation.

I prefer to modify the question to recovery of *combustible* in flyash since flyash proper cannot burn. A well-understood loss in boiler efficiency is by combustible in the ash either below grates or carried through to the stack. Reclaiming deposits from stack base and feeding them back into a boiler furnace consumes some combustible material that otherwise would be lost. Amount of combustible material in deposits may be considerable, but the practice of feeding it back to the furnace means that much of the material fed in is noncombustible.

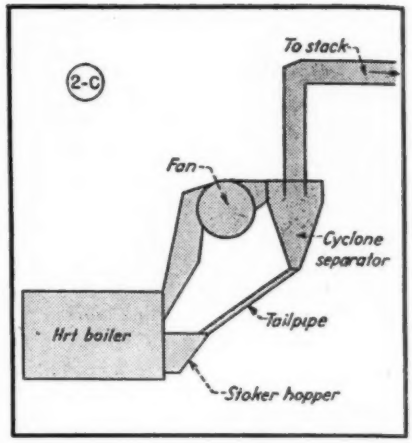
It is well to weigh the small gain by this practice against possible damage, resulting from the noncombustible fed into the furnace. A large portion is abrasive in character. Therefore, an increase in abrasive particles entrained in the gas flow will result. This is especially true with pulverized anthracite coal, but the abrasive effect may be noticeable with other fuels.

If gas flow is at high velocity and directed against surfaces of tubes or drums, erosive action may take place much the same as impingement from soot-blower jets. Photo 2-*A* shows failure of a tube reduced in thickness by flyash erosion. A crack in a tile baffle and the differential in pressure on each side caused the gas to direct the erosive ash against the tube where abrasive action continued to the point of failure.

Simplest method to reclaim deposits in the breeching is to provide a hopper in which deposits collect as at (*a*), 2-*B*. Deposits may then be piped downward to just outside the furnace wall where they may be fed to a burner of the type at (*b*) in the sketch.

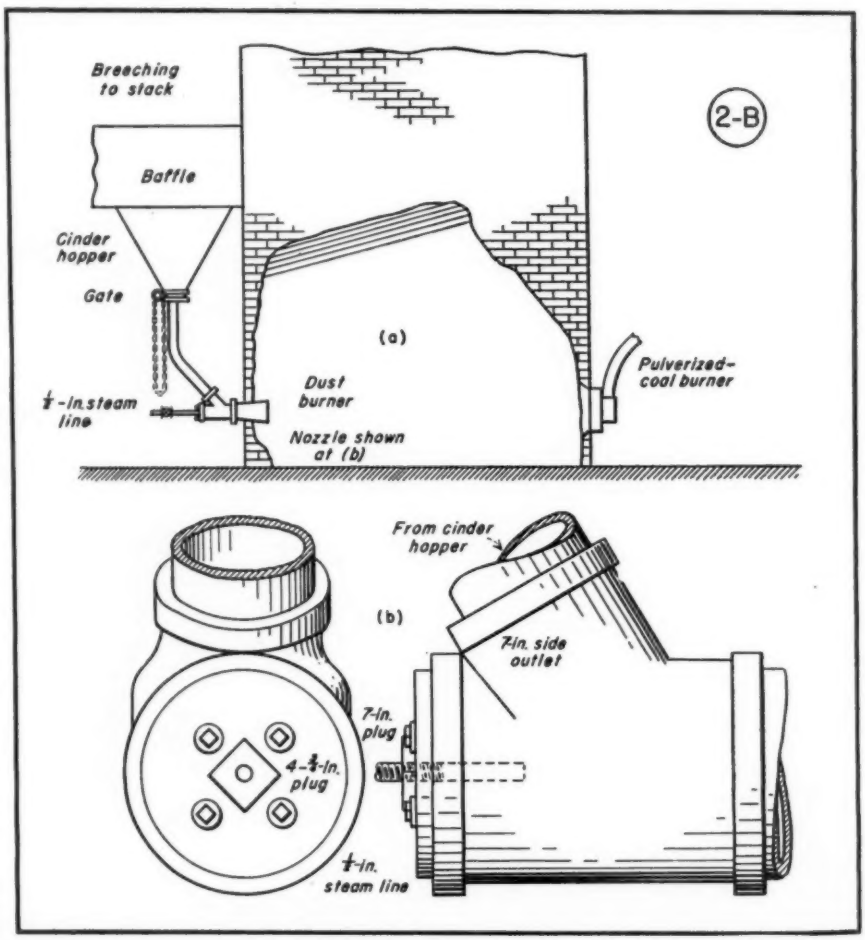
Periodic inspection of all heating surfaces, especially where change in direction or restriction of gas flow occurs, should be the practice. Erosive wear may be very gradual and difficult to detect. A highly polished surface on a tube or drum should lead to careful investigation.

Canton, Mass. H M SPRING



Use Cyclone to Reclaim Flyash

FLYASH FROM *LBN's* hrt boiler could be reclaimed by several methods, but least expensive and simplest is to in-

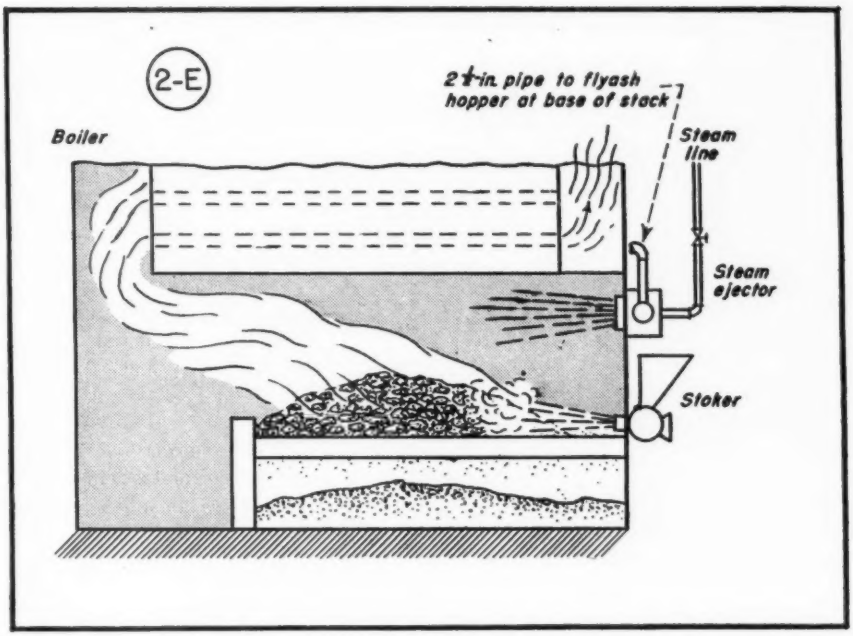


stall a cyclone separator in the breeching to the stack.

An arrangement is shown in 2-*C*. The gas carrying flyash from boiler passes through exhaust fan to cyclone and on to stack. Flyash and combustible matter collected is fed through the tailpipe from cyclone back to supply hopper for the stoker.

I suggest that *LBN* have a flyash sample analyzed to determine whether combustible-material percentage warrants an investment for its recovery.

Parr, S. C. V C SUMNER



Check the Economics Of Salvaging Flyash

LBN CAN SALVAGE coal particles for reburning by arranging a flyash trap in the chimney base. Arrange this trap to open when flyash reaches a definite level. From the trap, flyash is carried through a pipe by a suction-type blower and injected into the firebox. Blower does not have to run continuously but may start automatically when the flyash trap is opened. A timing relay can shut off the blower when all flyash has been consumed. Setting of this relay should be adjusted for field operating conditions.

Economics of the reclaiming method should be determined. If it requires considerable equipment, will its installation and operation cost effect a saving? If a manual method is considered, remember labor costs usually run high. The idea that "we have to pay the fireman anyway, so let him take care of this too," doesn't always work out economically. Usually some other operation is neglected or the fireman wants more compensation for additional duties.

Tenafly, N. J. K B HOFFMAN

Eductor Will Move Flyash to Furnace

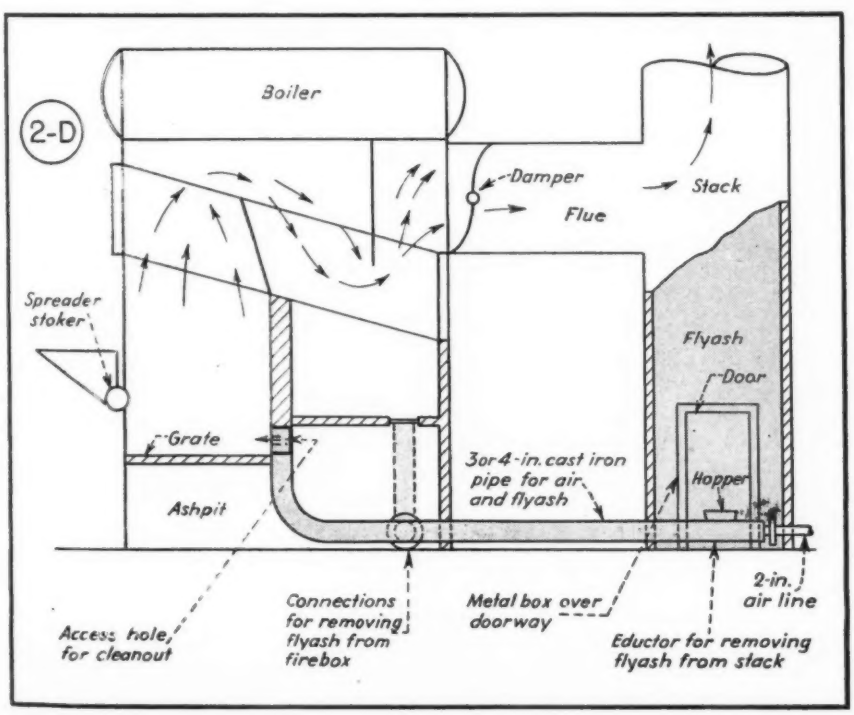
COMBUSTIBLE MATERIAL in flyash from a spreader stoker averages about 50% carbon. Amount by weight may run as high as 10% of coal burned. Assuming an average of 4% by weight of flyash to coal burned, loss is 4% x 50% x 14,700, or 294 Btu per lb coal burned. In addition to the fuel saving, a flyash-removing system reduces cost of manual flyash removal.

Recovery of flyash, by delivering it back to the furnace and burning it is quite practicable. Some spreader-stoker manufacturers make the equipment. A typical arrangement is shown in sketch 2-*D* where a steel box replaces the door at stack base. Inside the box, at the bottom and near the stack-door opening, is placed an eductor using air to convey the flyash. The air blows it as it falls into the eductor through the hopper. A 1/2-in. mesh screen is mounted over the hopper. A 3- or 4-in. conveying tube and a 2-in. air-supply line are large enough for boilers up to 50,000-lb-per-hr steam capacity.

Line from stack to boiler should be as direct as possible with long radius bends at turns.

The air can either be supplied by a small blower or taken from the compressed-air system.

Boston, Mass. N T PEF



Install Ejector on The Front of Boiler

IF LBN INSTALLS A FLYASH BURNER with steam jet to create a vacuum and draw flyash from chimney, he can blow it into furnace above stoker in one operation. The powdered carbon burns in suspension when mixed with hot air the same as pulverized coal. He should connect flyash hopper to burner with a 2½-in. pipe, sketch 2-*E*.

Denville, N. J. R SCHUSTER

RECIPROCATING-PUMP Q&A FOR POWER ENGINEERS

By E F WRIGHT

1—Steam End: Construction and Operation

First in a monthly series by E F Wright, acting chief engineer, reciprocating pump division, Worthington. This expert on reciprocating pumps has selected questions and answers that give practical understanding of these pumps, their construction, operation, characteristics, troubles and remedies.

Q 1—What is a reciprocating, positive-displacement pump?

A—It is a pump in which a piston in a cylinder positively displaces a given volume of fluid for each stroke. Piston area and its speed determine amount of fluid delivered. Variations in discharge pressure do not change appreciably the fluid volume displaced as long as sufficient power is applied to maintain constant piston speed.

Q 2—What are the essential parts of a reciprocating pump?

A—We will consider the fluid-handling portion and the driving mechanism separately.

Fluid end of pump, Fig. 1, consists of a liquid cylinder, complete with pistons and rods, suction and discharge valves and piping connections leading to and from suction and discharge chambers. For higher pressures outside-packed plungers are used instead of pistons and rods.

The driving mechanism of a direct-acting steam pump includes one or more steam cylinders with pistons, rods and valves, together with steam-valve actuating mechanism. Suitable steam and exhaust connections complete steam end of pump.

In what is commonly known as a power pump, the driving mechanism includes crankshaft, connecting rods and crossheads, supporting or inclosing framework and, frequently, built-in reduction gears. The power pump is, of course, complete only with the addition of some form of external driver, which may be an electric motor, internal-combustion engine or, occasionally, steam engine or turbine.

Q 3—How are direct-acting pumps classified?

A—By: (a) Number of working combinations of cylinders such as duplex, Fig. 2, which has two steam and two liquid cylinders; simplex, Fig. 9, which has one steam and one liquid cylinder. (b) Cylinder arrangement, whether horizontal or vertical. (c) Number of steam expansions in the power end, whether simple, compound or triple. Practically all direct-acting steam pumps are now built as simple pumps. (d) Fluid-end arrangement, whether piston type, outside or center-packed plunger, internal plunger and ring packing, or differential-piston type. (e) Service—high or low—depending on whether fluid-discharge pressure is

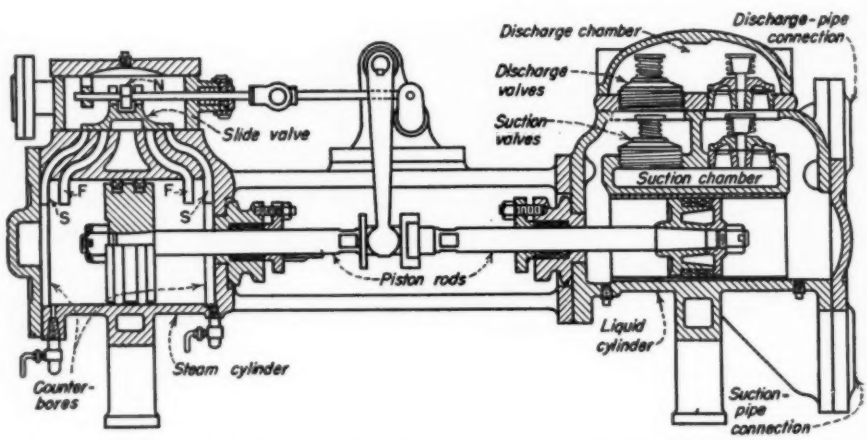


Fig. 1—Cross-section through direct-acting duplex reciprocating pump shows the steam piston and "D" slide valve, left; and fluid piston and valves, right

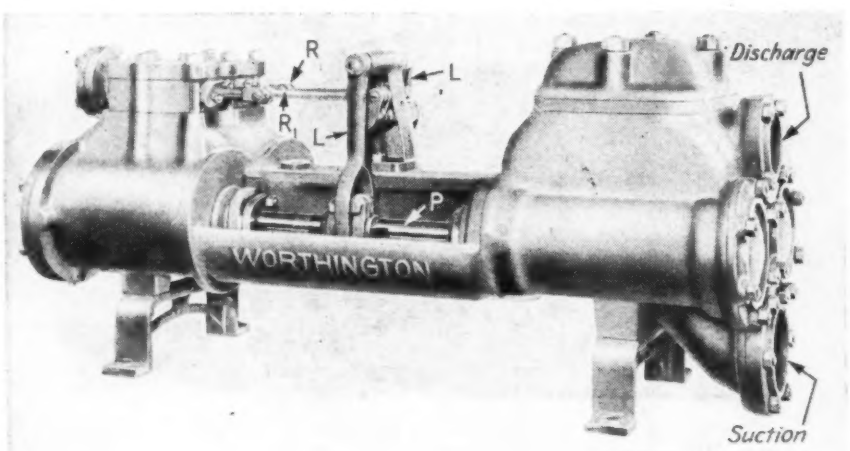
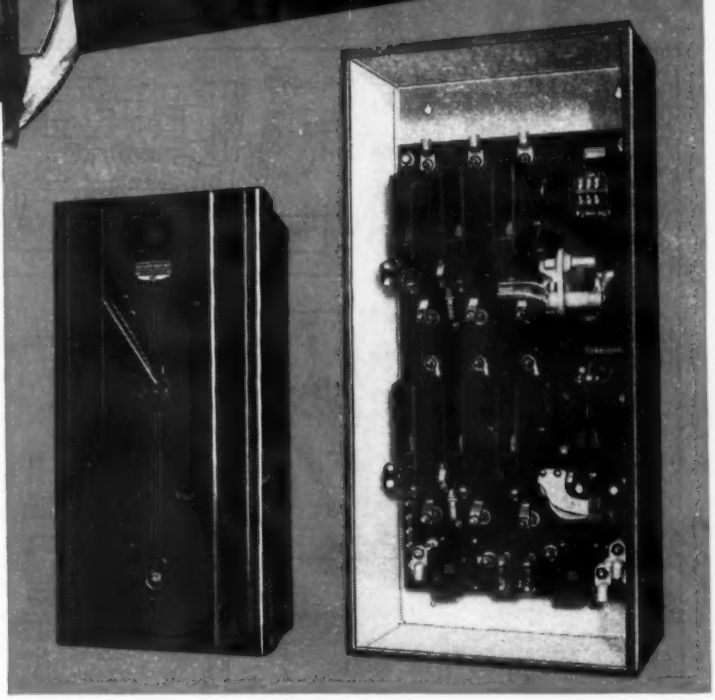


Fig. 2—A duplex direct-acting steam pump is in effect two single pumps set side by side and interconnected so main-piston rod motion of one pump controls the steam valve of the other, making it possible to drive the valves directly

Cutler-Hammer Combination Starters

. . . A UNION OF CONVENIENCE, ECONOMY AND WORLD-FAMOUS ENGINEERING



Cutler-Hammer Combination Starters offer many advantages that production-minded executives and experienced electrical supervisors are quick to recognize. Combining motor control *and* safety switch in one compact case, they save just about half the time required for mounting and wiring separate units. They effect savings throughout their long life by providing greater convenience in operation and maintenance. They protect motors against overload but, through use of the famous Cutler-Hammer Eutectic Alloy Overload Relay, they do not needlessly interrupt production on harmless current surges. They provide the smooth trouble-free performance of Cutler-Hammer Dust-safe Vertical Contact motor control and a motor-circuit switch built to the same high standard of engineering excellence. CUTLER-HAMMER, Inc., 1358 St. Paul Ave., Milwaukee 1, Wisconsin. Associate: Canadian Cutler-Hammer, Ltd., Toronto, Ontario.

CUTLER-HAMMER
MOTOR CONTROL
C-H

Look for these superiorities in C-H Combination Starters

Eutectic Alloy Overload Relay
This famous engineering achievement utilizes a fusible alloy with unvarying characteristics. Grips tight till the danger point is reached, then releases instantly to cut motor off the line. Resets without delay.

Dust-safe Vertical Contacts
Assure full metal-to-metal contacts. No arcing, burning, pitting or welding. No dressing or filing.

Trouble-free Safety Switch
The motor-circuit switch in a Cutler-Hammer Combination Starter is built to the same high standard of engineering excellence as the motor control.

Plenty More Features

- General purpose and NEMA types 1A, 4, 5, 7, and 9 special service enclosures.
- Heavy-duty contactors, open and accessible. Pivoted construction and self-aligning armature eliminate sliding friction, assure positive, equalized contact pressure and quiet operation.
- Magnet coils, vacuum-impregnated, solid 100% filled. Easily accessible.
- Disconnects; side-operated safety switch; front-operated contactor type or thermal type circuit breaker.
- Low voltage control circuit from self-contained transformer.
- Vise-type main circuit fuse clips.
- Reversing or non-reversing.
- Cadmium plating or stainless steel metal parts protect against rust.

PUMP Q&A

Continued

less or greater than the steam pressure.

Q 4—What is a duplex direct-acting steam pump?

A—It is in effect two single pumps set side by side, Fig. 2, and interconnected so the main-piston-rod motion of one pump controls the steam valve of the other. For example, in Fig. 2 piston rod P connects through a system of levers L to valve rod R on the opposite side of the pump. By a similar system of levers the piston rod on the pump's far side connects to valve rod R_1 on its near side. With this arrangement the steam valve may be driven directly without intervening parts such as springs or latches or the use of a steam-actuated valve under pilot-valve control. It is customary to build duplex pumps so the right-hand crosshead moves the left-hand steam valve in the same direction, thus making the left-hand side of the pump follow the motion of the right-hand side.

Q 5—Which is the right-hand side of a duplex steam pump?

A—When the observer stands at the steam end of the pump and faces toward the fluid end, the right-hand side of the pump is on his right. This rule also applies to power pumps with the observer at the power end and facing toward the fluid end.

Q 6—What type of steam valve is used in a duplex pump?

A—Most duplex steam pumps use a flat slide valve, Fig. 1, which is held against its seat by steam-chest pressure acting on its entire area, and hence is termed an unbalanced valve. The flat or "D" valve is satisfactory for steam pressure up to 175 or 200 psi and should have reasonable service life, particularly where steam-end lubrication is permissible. On large pumps the force required to move an unbalanced valve is considerable and a balanced piston valve, Fig. 3, has advantages. For high-pressure and highly superheated steam, the balanced valve is preferable for small pumps as well as large.

Q 7—Why are piston rings R and steam-chest liners L usually used with piston valves on duplex steam pumps, Fig. 3?

A—The lever connection to the piston-rod crosshead moves the steam valves of a duplex pump relatively slowly across the center position of its travel. Because of this slow motion, piston rings are necessary to keep wire-drawing or steam-cutting of the valve at a minimum, particularly as it crosses center position. Whenever piston rings are used on a piston steam valve, liners are required to provide the bridges on which the rings ride in crossing the ports to the main cylinder.

Q 8—Do steam valves of a direct-acting pump have steam and exhaust lap similar to the lap used in steam-engine valves?

A—In a direct-acting pump steam piston pressure is transmitted directly to the liquid piston. Since there is no flywheel or its equivalent, constant steam admission throughout the stroke is necessary to prevent stalling, particularly at low speed. The steam valve does not control cutoff, or compression and therefore does not require lap or lead.

Q 9—What is lost motion?

A—Lost motion is the play provided in the steam-valve operating mechanism of all direct-acting steam pumps. On small duplex pumps it is customary to use a single square valve-rod nut N Fig. 1, of a width somewhat less than the space between the two steam-valve abutments. This lost motion is not adjustable except by changing the thickness of the nut. On larger duplex

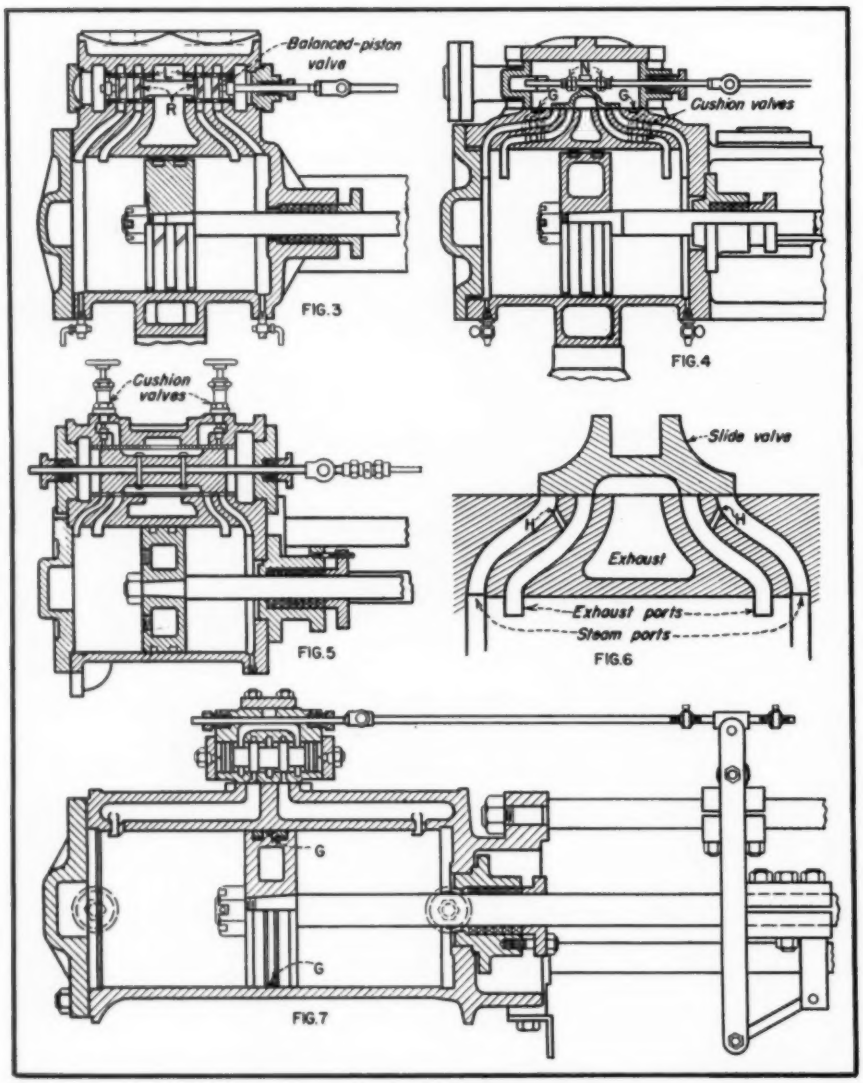
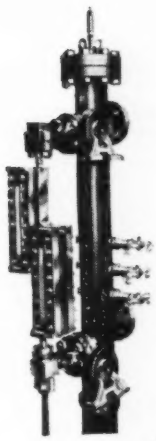


Fig. 3—On large pumps and for high-pressure superheated steam, balanced piston valves are used. Fig. 4—Adjustable lost motion on the valve stem is provided by two pairs of nuts, N. Fig. 5—On some pumps, valves are provided in passages between steam and exhaust ports to control main-piston cushioning. Fig. 6—Some pumps have small holes H drilled between the steam and exhaust ports to reduce cushioning. Fig. 7—Sometimes a groove G is cut in the piston between the rings to prevent the piston knocking following the valve reversal

NO S-T-R-E-T-C-H



NO SQUINT

?

NO GUESS

..about boiler water levels

Yarway's Remote Liquid Level Indicator brings hard-to-see overhead gage readings right down to eye level. There, on the instrument panel or other convenient place, on a brilliantly-lighted red and green dial is your constant, positive water level indication.

No more guessing either. The Yarway indicator shows water levels beyond the range of standard overhead gage glass... always indicates "High" or "Low", even when full or empty glass gages look the same.

Accuracy is assured because the indicator is operated by the boiler water itself. Action is instant, constant, practically frictionless. There are no stuffing boxes. Indicating mechanism is perfectly balanced on jewelled bearings outside of the pressure chamber.

Winning enthusiastic approval from coast to coast, nearly 3,000 have already been purchased... not only for indicating boiler water levels, but also feed heater water levels, superheater pressure differentials and tank levels.

Write for new Bulletin WG-1821.

YARNALL-WARING COMPANY, 100 Mermaid Ave., Phila. 18, Pa.

YARWAY REMOTE LIQUID LEVEL INDICATOR

PUMP Q&A

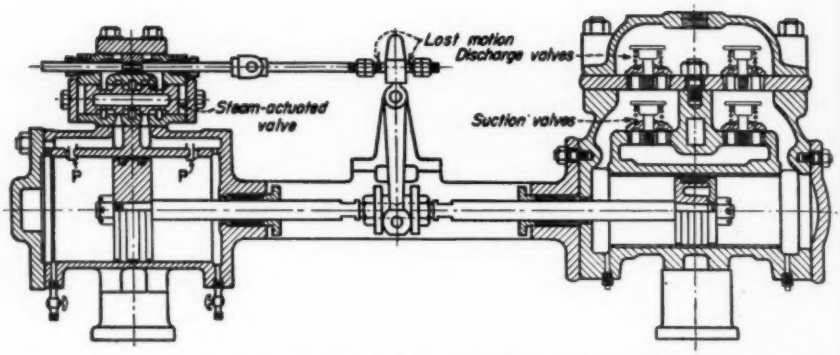


Fig. 8—Cross-section through direct-acting simplex reciprocating pump shows steam piston and steam-actuated main valve, left; fluid piston, valves, right

pumps pairs of nuts, *N*, locked together may be used on either side of a single abutment on the valve, Fig. 4, or an equivalent arrangement provided outside the valve chest. This construction provides for adjusting the lost motion and varying the valve travel in either direction to obtain best operating results.

Q 10—*How much lost motion is provided in a duplex steam pump?*

A—It equals one quarter to three eighths valve-rod travel. With valve-rod linkage designed to give full port opening at rated pump stroke, total lost motion is less than steam-port width.

Q 11—*What controls stroke length of a duplex pump and how is the piston stopped without undue shock?*

A—Exhaust ports *F*, Fig. 1, in a duplex pump's steam cylinders terminate in the cylinders' bore some distance from the end of piston travel. Separate steam ports *S*, nearly always exhaust-port size, run to the counterbores at the cylinder's ends. As it approaches the end of its stroke the steam piston cuts off the exhaust port, trapping steam which is compressed by the piston's motion. This cushion brings the piston to a stop with a minimum of shock in the liquid end, even though steam is not cut off from the piston's other side until the piston in the pump's opposite side has passed midstroke.

Q 12—*What are cushion valves?*

A—On large steam pumps valves are provided in a passage leading from the steam to the exhaust port, Fig. 4 and 5, to control the effect of steam trapped between the piston and cylinder head. Opening these valves permits the trapped cushion steam to leak through to the exhaust port to reduce the effect of the cushion. Closing them stops the leakoff and causes maximum cushioning effect. On small pumps for service where relatively little steam cushion is needed small holes are sometimes drilled through the bridge between steam and exhaust ports, Fig. 6. These provide a fixed leakoff like that obtained through an open cushion valve.

Q 13—*What is a simplex direct-acting steam pump?*

A—It is a pump with a single liquid cylinder and piston in line with and operated by a single steam piston and cylinder, Fig. 9. The main piston is controlled by a steam-actuated main valve, Fig. 8, controlled by a pilot valve. This valve is operated from a crosshead on the main piston rod through a system of levers and valve rods. Many arrangements of main valve, pilot and operating levers have been used since the original direct-acting simplex steam pump was invented.

Q 14—*How much lost motion is provided in a simplex steam pump?*

A—On a simplex steam pump the pilot valve is much smaller than the steam valve of a duplex pump and hence requires less movement to obtain full port opening. In spite of a somewhat lower actuating-lever ratio than that used on a duplex pump, practically all its movement is absorbed in lost motion. A simplex pump's valve-gear lost motion is set with the pump in operation to get full stroke and a smooth reversal, rather than setting it as a definite proportion of the actuating-tappet travel. This makes it necessary to use an external lost motion as at *L*, Fig. 9, on all sizes of pumps instead of only on the larger sizes as in duplex pumps.

Q 15—*How is a simplex steam cylinder arranged for cushioning main-piston travel?*

A—Most simplex steam cylinders are made with a main port *P*, Fig. 8, serv-

(*Continued on page* 148)

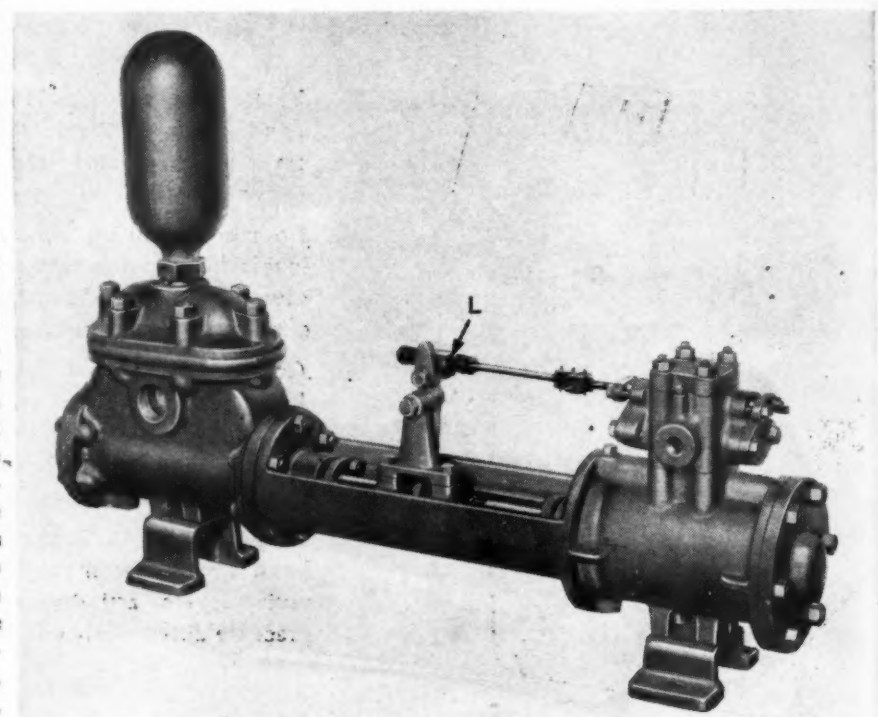
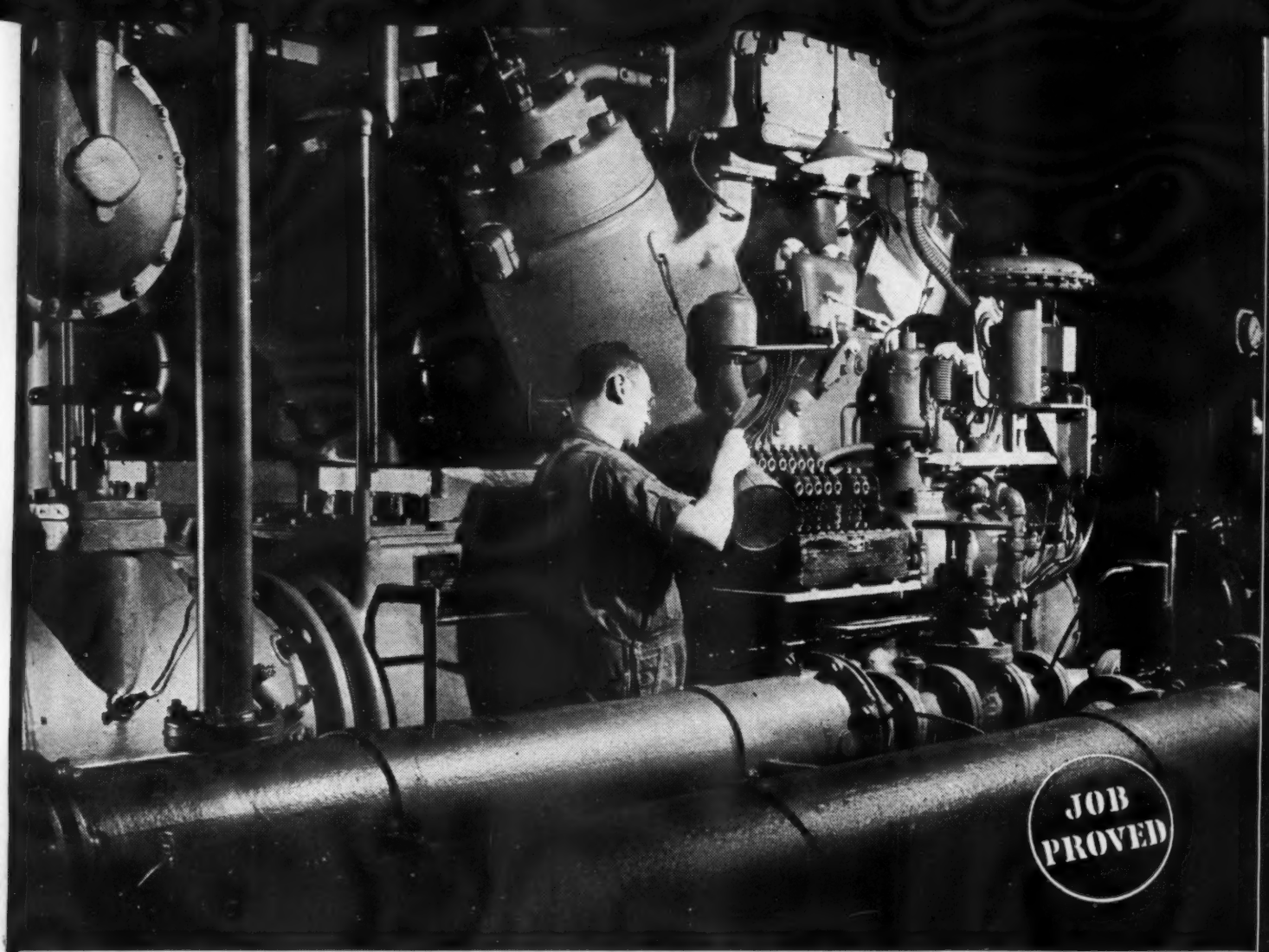


Fig. 9—A simplex direct-acting steam pump has a single liquid cylinder and piston in line with and directly operated by a single steam piston and cylinder



GIVING *the Air* TO LUBRICATION PROBLEMS

SUN DIESEL LUBRICANT . . .

Keeps 400-H.P. Diesel Compressors Going 24 Hours a Day . . . with No Apparent Wear

For three years these 2-cycle 400-H.P. Diesel compressors ran almost continuously. Night and day . . . week after week . . . they piled up over 20,000 hours of operation.

Lubrication problems didn't exist for these engines, according to engineers. A "Job-Proved" Sun oil, specially developed for Diesels, was used from the very first day. When the engines were finally disassembled there were no stuck rings, no hard carbon or gummy deposits.

No wear was apparent. No replacement of parts was necessary.

Sun Diesel lubricants are low in carbon. They withstand extreme pressures and temperatures. They stand up on heavy-duty jobs. Call the Sun man near you for full information on the petroleum products that are "Job-Proved."

SUN OIL COMPANY • ***Philadelphia 3, Pa.***
Sponsors of the Sunoco News-Voice of the Air—Lowell Thomas

SUN
SUNOCO
INDUSTRIAL PRODUCTS

REFRIGERATION NOTEBOOK — 30

Cylinder Losses in a Refrigerant Compressor

BY TERRY MITCHELL, ME, *Frick Company*

► MANY ENGINEERS THINK the only two losses to consider in a refrigerant compressor are leakage (past valves and piston rings) and wasteful clearance. But that is only half the story.

Leakage, a mechanical loss, may average 1% in an inclosed machine one year old. If it is serious the compression curve on the indicator card shifts from its normal position (halfway between the isothermal and adiabatic lines). Leaky discharge valves move the curve above the adiabatic line; leaky suction valves or piston rings put the curve too far below it.

Poppet-type valves hold best if the seats are ground to a thin line of contact only. Plate valves rarely require grinding-in but they should be flat, and free from grooves. They can be removed and tested for tightness with kerosene. When dismantling or assembling the compressor protect the piston rings with a guide sleeve of the same diameter as the piston. Clearance between the beveled ends of each contracted ring should be not over 0.001 in. per in. of cylinder *circumference*, as in the photo.

Cylinder clearance usually has a greater effect on volumetric efficiency than leakage. Even though piston rods and bearings are adjusted so that each piston practically "kisses" the cylinder head at the end of its stroke, there is still some clearance beneath the discharge valves unless they are the old-style poppet type. It is difficult to reduce the clearance volume below 2% in designing a machine to run at 300 to 500 rpm.

Compressed gas, which pockets in the clearance space, re-expands as the piston starts backward, and prevents prompt opening of the suction valve. This expansion is in proportion to the compression ratio, and is influenced by the suction and discharge pressures. Harmful effect of clearance may thus be several times the percentage of the clearance itself. If machine handles wet gas, (evidenced by frost on the cylinders) re-expansion loss is multiplied: droplets of the liquid, heated during compression, flash into considerable volume of gas on the back stroke and retard gas intake.

On the other hand, the indicated horsepower per ton refrigeration of the machine does not change much with changes in clearance, if the operating pressures remain the same: This is because clearance affects the capacity and indicated horsepower in the same direction.

When cold suction gas enters the compressor it becomes superheated. While this cannot be detected on the indicator card, the loss in gas (by weight) drawn into the cylinder is nevertheless there. No reliable way to measure this loss has yet been found, but it does increase the horsepower required to drive the machine, per ton of the total refrigeration produced.

Sleeve A contracts the rings when putting the piston in a cylinder or measuring ring-gap. Clearance should be 0.001 in. per in. of cylinder circumference

VALVE ACTION

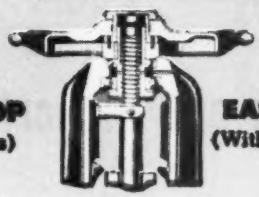
Another loss is from wiredrawing, the pressure drop caused when a gas must force its way through restricted passages. Valves open only when there is a difference in pressure on the two sides: the opening is affected by the valve weight, spring tension, dashpot action, inertia, gas density, and velocity. Total wiredrawing losses may range up to as much as 15%.

Combined losses from superheating and wiredrawing can be calculated by measuring the actual over-all volumetric efficiency of the machine and then making proper allowances for leakage loss and clearance. Then find total efficiency by multiplying the percent efficiencies due to leakage, clearance, and superheat and wiredrawing. It is "the percent of the percent" multiplying effect that makes even a good machine have an actual volumetric efficiency nearer 80% than the perfect 100%.

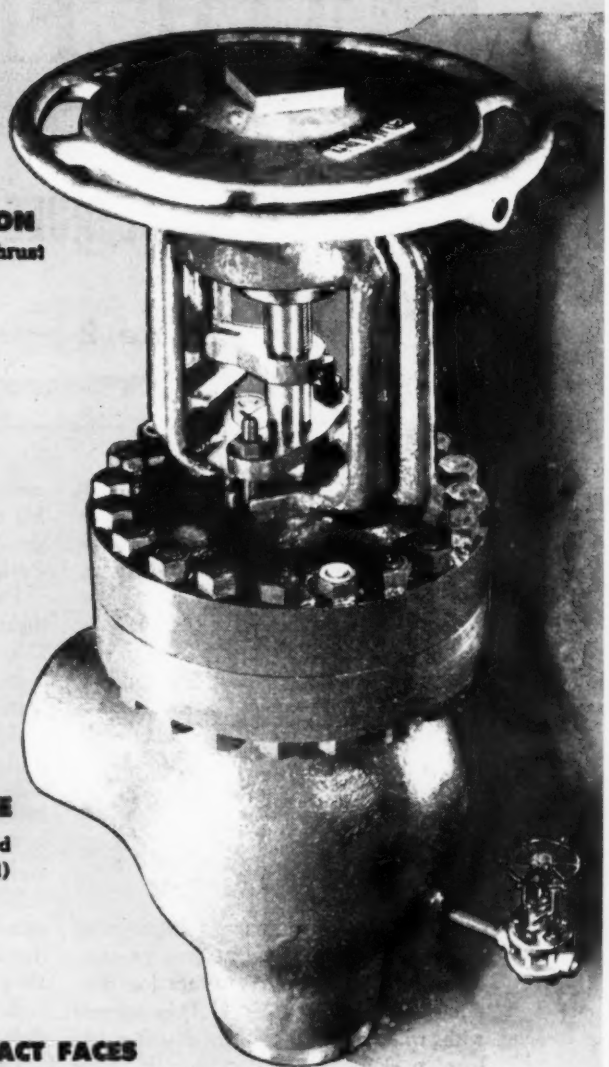
ou Get All These Features In
dward NON-RETURN Valves

Together, these features of Edward non-return valve design increase boiler plant efficiency, cut operating costs, give maximum protection in an emergency. They are among the reasons Edward non-return valves are specified for a majority of the stations where service conditions are the most exacting.

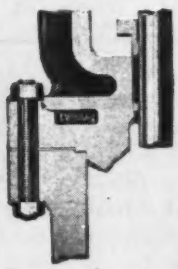
MINIMUM PRESSURE DROP
(With gadget-free flow passages)



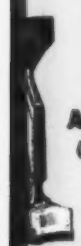
EASY OPERATION
(With patented EValthrust yoke bushing)



Y DISASSEMBLY
gh Edward EVinlay -bearing surfaces)



HOUR-GLASS DISK-PISTON
(To further cut pressure loss)



ACCURATE GUIDING
(With integral cored-out guide ribs)

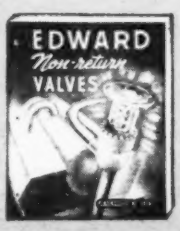
MAXIMUM CLOSING TORQUE
(With patented Edward Impactor handwheel)

URE SEATING
th Edward guide-lip disk)

PLUS LONG LIFE OF CONTACT FACES
(Through throttling action of disk lip)

PRESSURE SEAL BONNET AVAILABLE
(New simplified body-bonnet connection)

THIS CATALOG



goes into detail on all these features, and describes and illustrates completely Edward non-return valves for 150 lb. up. . . . Write for Catalog 12-B.

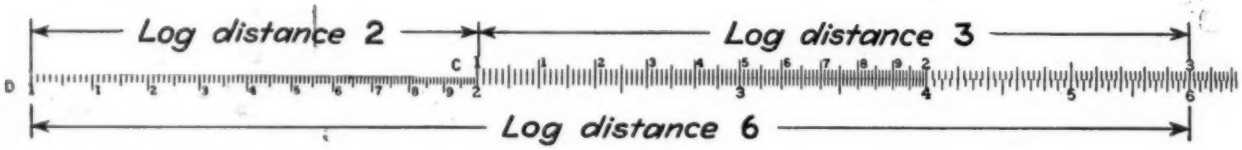
Edward Valves, Inc.

SUBSIDIARY OF ROCKWELL MANUFACTURING CO EAST CHICAGO, INDIANA

MATH TIPS

JOHN KING* GIVES HELPFUL HINTS TO EVERYDAY USERS OF NUMBERS AND HOMESPUN MATHEMATICS

16—SLIDE RULE: Division and Proportion, Part 2



▶ BEFORE STARTING THIS PAGE, reread Part 1 on the slide rule, p 120, August POWER. Remember the rule for multiplication: To multiply two numbers, locate one on the *D* scale, and place either the 1 or 10 index *C* scale over it. Locate second number on *C* scale, and move indicator until it coincides with this number. If you select the wrong index, the second number will be off *D* scale; in this case use other index. Answer is under indicator on *D* scale. Also remember that to multiply on the slide rule you add log distances.

DIVISION BY SLIDE RULE

From this it is easy to deduce that to divide, which is the reverse process of multiplication, you subtract log distances on the slide rule. This agrees with what we learned in division by logs p 122, June POWER. By this method to divide 6 by 3 we subtract the log distance 3 from log distance 6 and get log distance 2 as shown above.

Problem: $8 \div 2 = ?$

Find 8 on *D* scale and set the indicator over it. Move the slide until 2, *C* scale, lines up with the hairline of indicator. Read 4, the answer, on *D* scale under index 1 at left end of *C* scale. Note that only one index of *C* scale is on *D* scale, and that it always indicates the answer in division.

Problem: $35 \div 5 = ?$

Set indicator over 3 and 5 or long mark halfway between 3 and 4 on *D* scale; move slide until 5 of *C* scale coincides with hairline of indicator. Read answer 7 on *D* scale under index 10 (at right end of *C* scale) Fig. 1.

Here is the rule for division on a slide rule:

To divide one number by another locate the first number (dividend) on *D* scale by placing the hairline of indicator over it. Move slide until second number (divisor) is lined up with hairline of indicator. The answer is found on *D* scale under the index of *C* scale.

Try the following simple division problems, and check the results, by long-hand if necessary:

$19.8 \div 4.4 = 4.5$; $9.45 \div 4.15 = 2.275$; $43 \div 69 = 0.623$; $15.2 \div 4.3 = 35.4$; $870 \div 2.54 = 342$.

PROPORTION IS EASY

Proportion is a special case of multiplication and division in which the two fractions of division are always equal. It is commonly written 3:6::4:8, and read 3 is to 6 as 4 is to 8. It can also be written $3/6 = 4/8$. This is the way we generally find it in engineering. Proportion is one of the simplest and easiest problems to work on the slide rule; its simplicity comes from the similarity of the problem as written above and the location of the numbers on the slide rule when the problem is worked as shown in Fig. 2.

The problem comes from one of the factors being unknown thus $3/6 = x/8$. The unknown can be any of the factors and the combination can be inverted thus $6/3 = 8/x$. To solve the original problem set 3 on *C* scale over 6 on *D* scale; 4 on *C* scale (unknown) falls over 8 on *D* scale. If one of the factors is missing it is found by comparing the face of the slide rule to the problem after slide has been adjusted to the known factor as in Fig. 2. Try several proportion problems of your own.

Squares and cubes on the slide rule will be explained in the October issue.

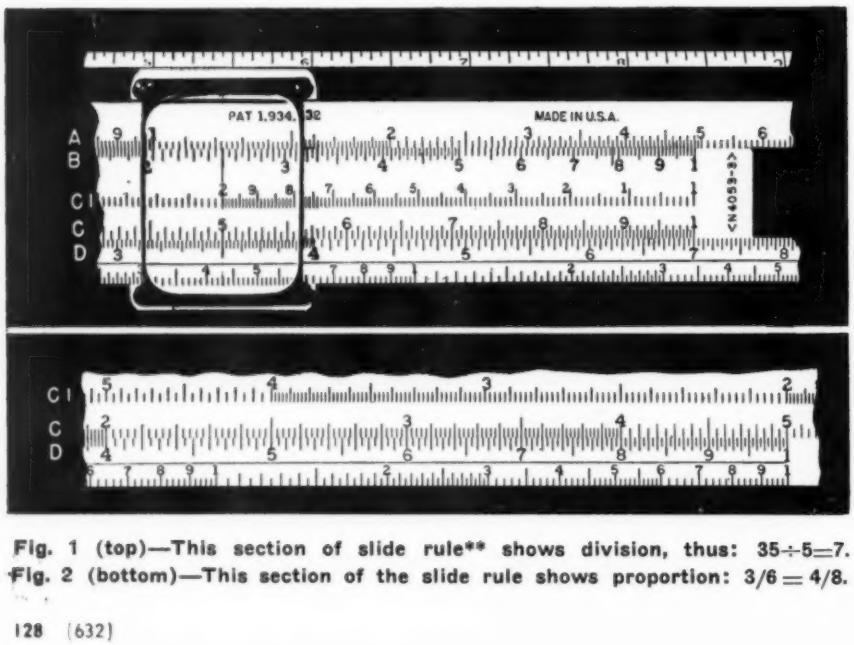
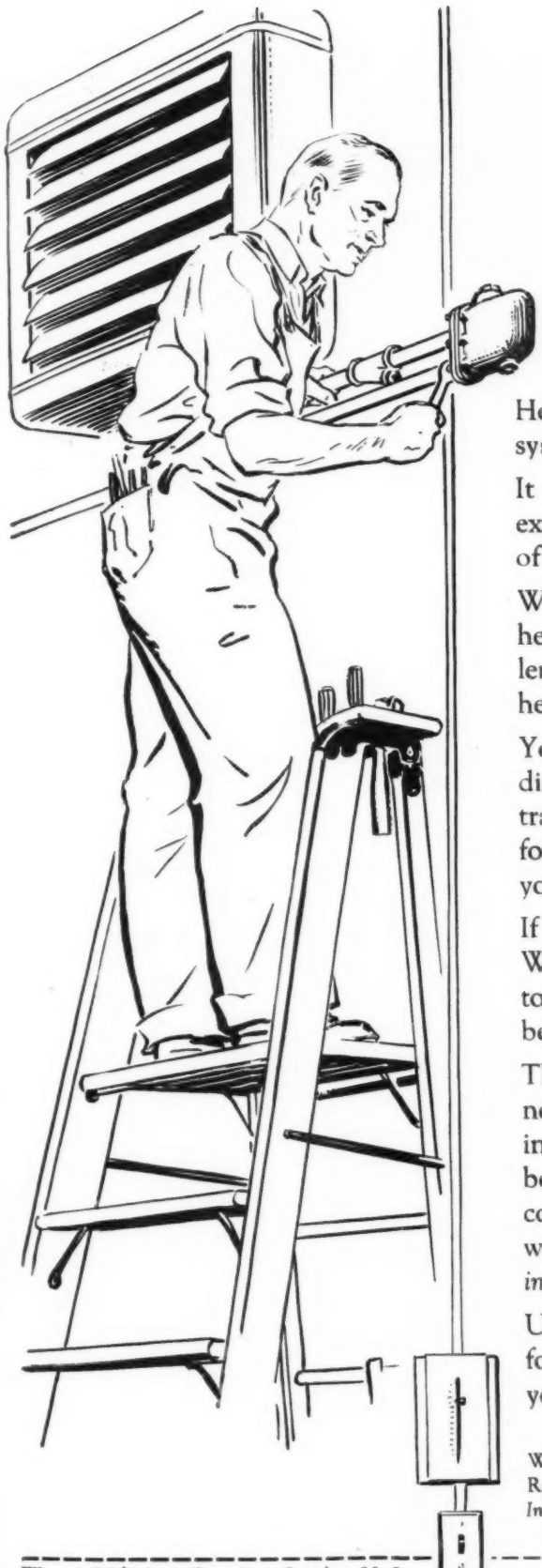


Fig. 1 (top)—This section of slide rule shows division, thus: 35÷5=7. Fig. 2 (bottom)—This section of the slide rule shows proportion: 3/6 = 4/8.**

* While Phil Swain is in the South Pacific, for POWER and the other McGraw-Hill publications, observing the U. S. atom-bomb test, Assistant Editor John L King takes over the Math Tips series.

** Slide rule, courtesy Keuffel & Esser Co, N. Y.



First Aid for the Man in Charge of Heating Repairs

Here is a practical program for getting your heating system in shape before snow flies.

It starts with a coupon. It brings into your building the experience of the Webster Organization in the heating of thousands of buildings.

Webster not only has the repair parts to bring your heating system up to 100% efficiency, but they also will lend tools and furnish written instructions to your heating contractor or installer.

You can get *immediate delivery* on replacement bellows, diaphragms, nuts and nipples for thermostatic radiator traps; packing rings, discs, handles, nuts and nipples for radiator valves; and many other repair parts for your Webster Heating System equipment.

If you have worn-out or inoperative radiator traps, use Webster Replacement Thermostats to bring them up to new trap efficiency. The original trap body need not be removed.

This is all you do . . . Remove the old seat. Insert the new seat. Screw the replacement diaphragm or bellows into the original cap after the inoperative assembly has been removed. Webster Replacement Thermostats are complete assemblies—Sylphon Bellows or Diaphragm with valve piece and seat. And they are ready for *immediate delivery.*

Use coupon now. Immediately on receipt it will be forwarded to the Webster Representative serving in your vicinity.

WARREN WEBSTER & CO., Camden, N.J.
Representatives in principal Cities:: Est. 1888
In Canada, Darling Brothers, Limited, Montreal

BY THE MAKERS OF
Webster
HEATING SYSTEMS

Warren Webster & Company, Camden, N. J.

I want to see a Webster Representative about:

☐ Radiator Trap bellows, diaphragms, nuts and nipples; ☐ Radiator valve packing rings, discs, handles, nuts and nipples; ☐ Float and Thermostatic Trap Parts (Series 26); ☐ Strainer Baskets; ☐ Boiler Return Trap Interiors; ☐ Vent Trap Interiors; ☐ Thermostatic Radiator Traps; ☐ Radiator Valves.

NAME _____ TITLE _____

BUILDING OR COMPANY _____

ADDRESS _____

HOW TO BUILD A JIG FOR FLAME-HARDENING

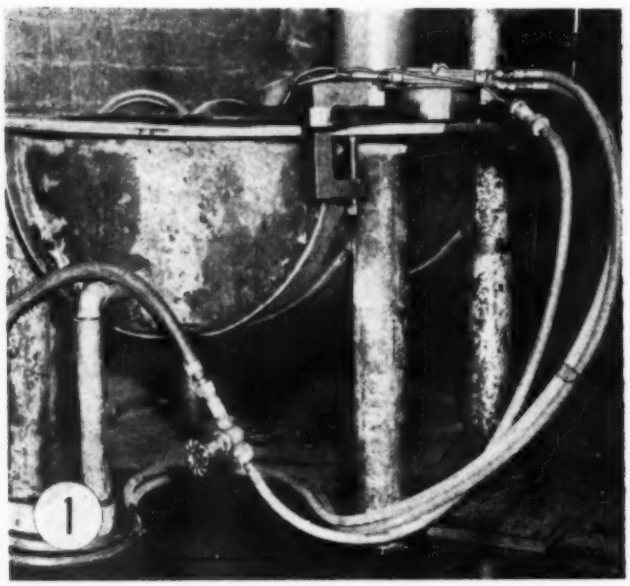
▶ ORDINARY HEATING (for hardening purposes), such as a forge or furnace affords, raises steel temperature so slowly that the part is heated uniformly throughout, and consequent quenching therefore hardens the entire mass. This is often undesirable because the job may require a tough, ductile core and hard wear-resisting surface.

An oxyacetylene torch, as the heating medium, makes it possible to raise the object's surface temperature so rapidly that it can be hardened without affecting the core-metal characteristics. Heating and quenching are carried out quickly in one operation before heat penetrates any appreciable depth into body of metal.

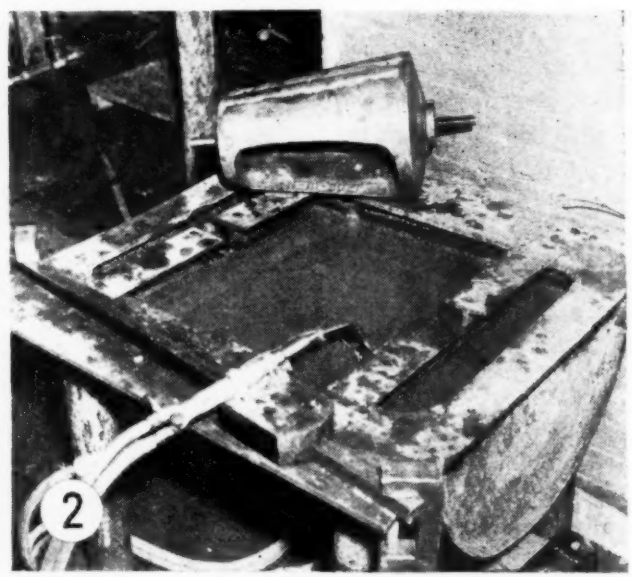
Any steel that can be hardened by simple heating and quenching can be treated by the flame-hardening process, but the degree to which plain carbon steel can be quench-hardened depends on carbon content. To obtain a reasonable increase in hardness, steel should contain at least 0.40 percent carbon.

Most desirable steels for flame-hardening are straight carbon or low-alloy metals. These usually harden to a satisfactory degree and, except for certain types, withstand heating and quenching without checking or cracking.

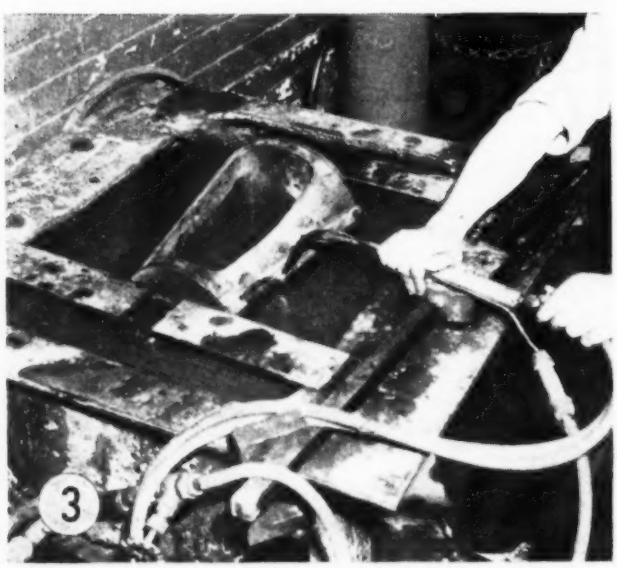
The simple hand-operated jig described below can be used to harden valve plugs and other circular objects of different lengths. It is well adapted for plant work where miscellaneous parts of many sizes must be treated.
Courtesy of The Linde Air Products Co.



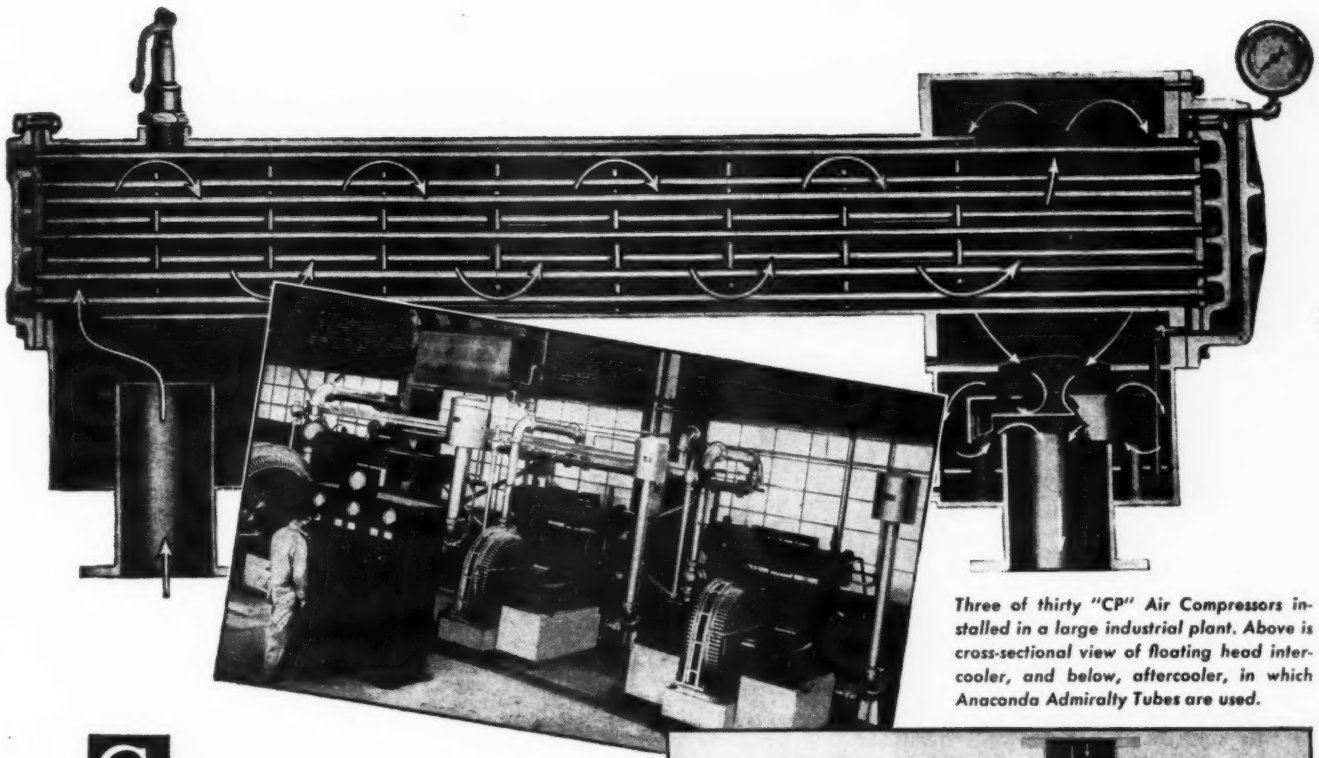
1 Tank made from a steel drum, fitted with legs, holds water bath that protects the hardened portion of the work against further heating. Quenching-water nozzle and supply hose are fastened to and move with the torch.



2 Acetylene torch mounts solidly on a movable slotted block that the operator slides along a bar clamped to tank top. Guide bar is movable and can be lined up parallel with the surface of the object being treated.

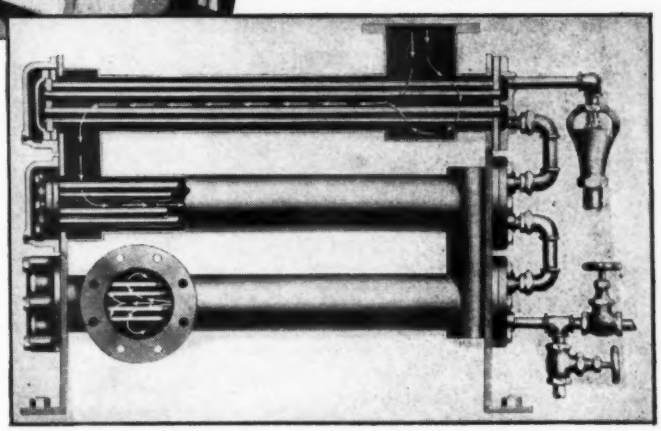


3 Slotted I-beams support object being flame-hardened; one support is made movable to facilitate handling parts of widely different lengths. Setup shows how one segment of a valve-plug surface is hardened at a time.



Three of thirty "CP" Air Compressors installed in a large industrial plant. Above is cross-sectional view of floating head intercooler, and below, aftercooler, in which Anaconda Admiralty Tubes are used.

CP Compressed Air for Industry—*cooled in* Anaconda Admiralty Tubes



IN U. S. NAVY and Merchant Marine vessels, in mines, petroleum refineries, chemical plants and other industrial establishments, Chicago Pneumatic Air Compressors are on the job delivering compressed air to pneumatic tools and equipment.

Intercoolers and aftercoolers on many of these units are equipped with Anaconda Admiralty Tubes, which are furnished by The American Brass Company in 7, 10 and 12 ft. lengths, ¾ in. and 1 in. O.D.

Anaconda Tubes are produced in 11 standard and several special alloys for use in condensers and heat exchangers. The wide range available permits use of the most economical tube alloy in almost any type of heat transfer equipment for practically any operating condition.

Assistance in selecting Anaconda Condenser Tube Alloys to meet your specific requirements is provided by engineers of our Technical Department. For detailed information on Anaconda Condenser Tube and Tube Sheet Alloys, write for Publication B-2.

46176

ANACONDA

Anaconda

CONDENSER TUBES

THE AMERICAN BRASS COMPANY

General Offices: Waterbury 88, Connecticut

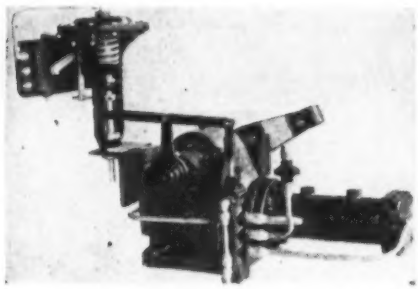
Subsidiary of Anaconda Copper Mining Company

In Canada: ANACONDA AMERICAN BRASS LTD., *New Toronto, Ont.*

WHAT'S New IN PLANT EQUIPMENT

Centrifugal Pump

WARREN SINGLE-STAGE DOUBLE-SUCTION DBL centrifugal pump has 50- to 600-gpm capacity. Heads are 120 to 260 ft, operating at 3500 rpm. It is available in 1¼-, 2½- and 3-in. discharge sizes and with either right- or left-hand rotation. Bronze-fitted pump is standard but special metals can be furnished for specific services. **Dept P, Warren Steam Pump Co, Warren, Mass.**



Booster Cylinder

OIL-OPERATED hydraulic booster cylinder for air-operated controllers is a wartime development. Using a standard diaphragm top it provides high-power amplification and permits exact positioning of heavy dampers, valves, etc, in accordance with applied pneumatic loading pressure, usually 0 to 15 psi. Cylinder may be of crank design, as shown, or of straight reciprocating design. Straight cylinders are available up to 8-in. bore and 30-in. stroke. Other remote positioning cylinders are available using electric instead of pneumatic transmission. **Dept P, Askania Regulator Co, 1603 S Michigan Ave, Chicago, Ill.**

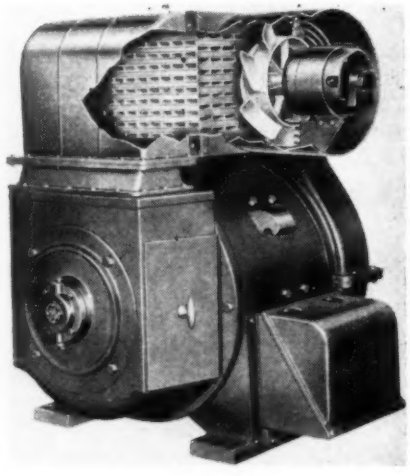
Portable Arc-Welder

ZIPPER-ET, a small portable electric welder, operates on 110-v ac current. Complete with all accessories, it is self-contained and has a total weight of about 40 lb. Heavy-gage metal case has sturdy carrying handle securely fastened at top. Entire case lifts from a deep tray, which fits snugly into bottom of case. Within the case is a transformer which is burn-out proofed, with spun-glass insulation. It has a separate primary winding and secondary winding, without any electrical connection between them. *Zipper-et* handles five sizes of welding rod, from $\frac{1}{32}$ to $\frac{3}{32}$ in. It handles $\frac{1}{4}$ in. carbons in the 9000-arc torch as ably as larger, heavy-duty Mid-States welders. **Dept P, Mid-States Equipment Corp, 2429 S Michigan Ave, Chicago 16, Ill.**

Unit-Cooled Motors

FOR OPERATION in severe atmospheric conditions, unit-cooled, totally inclosed dc motors are available in 15- to 200-hp sizes at popular speeds and voltages. Dual ventilating system utilizes a compact unit cooler operating on a principle similar to that of an automobile radiator except that air instead of water is used for cooling. The unit cooler has two sets of air passages arranged at right angles to each other. Fan on armature circulates air through motor and through one set of passages forming a completely inclosed system. External air, maintained at a constant flow rate by an auxiliary motor and fan, travels through other set of passages to absorb heat from inclosed system. By utilizing this principle, a totally inclosed construction is achieved without external duct work, piping, air filters or pressurized air supply.

Even though completely inclosed, vital parts of motor are accessible for periodic maintenance and inspection. New motors can be furnished with ball or sleeve bearings. Constant speed motors in the new line are available with shunt, stabilized shunt or compound windings. Adjustable speed ratings are shunt or stabilized shunt wound. **Dept P, General Electric Co, Schenectady, N. Y.**

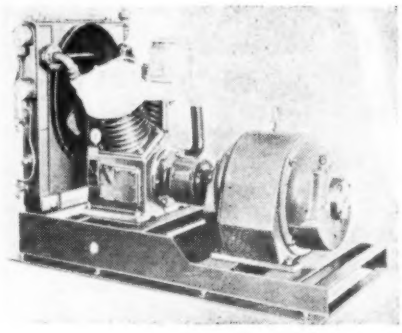


Speed Reducers

CONE-DRIVE SPEED REDUCERS have double-enveloping *Cone-Drive* gearing, which is claimed to permit greater compactness of housings as result of greater contact per tooth and more teeth in contact. New line embraces models from fractional hp ratings to inputs of 800 hp to the pinion.

Standardized *Cone-Drive* gear sets and *Cone-Drive* pinion and gear mountings are on all models. Assemblies are either right or left hand. Available ratios range from 5:1 to 70:1. Extended pinion and gear-shaft models are also available. All parts for any model of a given size are interchangeable.

Every model has cooling fins. All new reducers, from 4 to 18 in. center distance inclusive, can be equipped with water-cooling coils to provide increased thermal capacity where required. **Dept P, Michigan Tool Co, 7171 E McNichols Rd, Detroit 12, Mich.**



Air Compressors

AVAILABLE IN 60-, 105-, 160-, 210- and 315-cfm sizes, departmental compressors are for installation in individual plant departments. The departmental system is a departure from the conventional central system where a large compressor pipes air to various departments. Under the departmental system, for example, if six departments require compressed air, six separate compressors of proper capacities are installed. Each operates independently but several units are connected together to provide a power reserve for overpeak loads, or maintain service in case of breakdowns. **Dept P, Davey Compressor Co, Kent, O.**

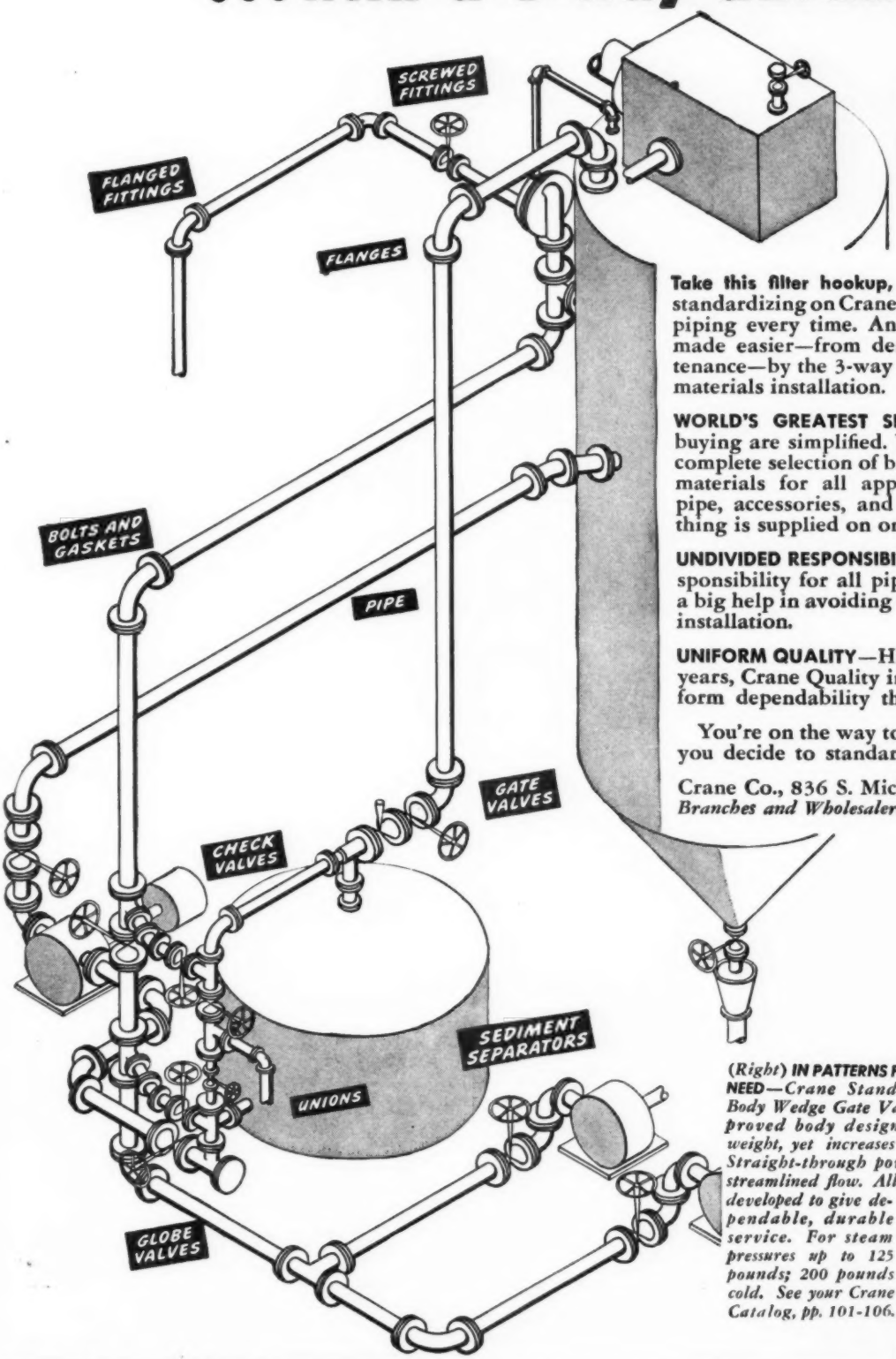
Hydraulic Motor

SUPERDRAULIC TRIPORT MOTOR parallels the *Superdraulic* line of high-pressure hydraulic pumps, making available a perfectly balanced combination of pumps and motors, each designed, according to maker, to insure efficient operation when combined as a complete transmission system.

The 47-hp motor is only 10½ in. in dia and light enough to be easily handled by

POWER brings this monthly survey of new equipment as one of its many reader services. In requesting additional information from manufacturers, please identify the source of your inquiry by referring to Dept. P.

The ONE way to better piping ...with a 3-way advantage



ONE
SOURCE OF SUPPLY
RESPONSIBILITY
STANDARD OF QUALITY

Take this filter hookup, for example, to see how standardizing on Crane equipment results in better piping every time. And how any piping job is made easier—from design to erection to maintenance—by the 3-way advantage of an all-Crane materials installation.

WORLD'S GREATEST SELECTION—Specifying and buying are simplified. You choose from the most complete selection of brass, iron, and steel piping materials for all applications. Valves, fittings, pipe, accessories, and fabricated piping—everything is supplied on one order to Crane.

UNDIVIDED RESPONSIBILITY—You put complete responsibility for all piping materials on Crane—a big help in avoiding delays and getting the best installation.

UNIFORM QUALITY—Highly respected through 90 years, Crane Quality in all materials assures uniform dependability throughout piping systems.

You're on the way to better piping the moment you decide to standardize on Crane equipment.

Crane Co., 836 S. Michigan Ave., Chicago 5, Ill.
Branches and Wholesalers Serving All Industrial Areas

(*Right*) **IN PATTERNS FOR EVERY NEED**—*Crane Standard Iron Body Wedge Gate Valves. Improved body design reduces weight, yet increases strength. Straight-through ports assure streamlined flow. All parts developed to give dependable, durable service. For steam pressures up to 125 pounds; 200 pounds cold. See your Crane Catalog, pp. 101-106.*

EVERYTHING FROM . . .

VALVES • FITTINGS
PIPE • PLUMBING
HEATING • PUMPS

CRANE

FOR EVERY PIPING SYSTEM

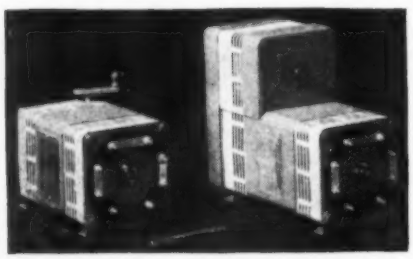
one man. Torque range is as high as 200 ft-lb. Motor is available in two types, one rated at 26½ gpm with 3500 psi, input at 1200 rpm; the other at 19 gpm with 5000 psi at 1200 rpm.

This motor is said to hold many advantages for industrial machine applications, including infinitely variable-speed control, forward and reverse, by a convenient finger-volume-control valve; starting without clutches; and perfect control of acceleration and deceleration. Because of its unique design, which provides 66 power strokes per revolution, motor is said to have turbine smoothness. **Dept P, Superdraulic Corp, Dearborn, Mich.**

Self-Hardening Electrode

EXTRUSION-COATED self-hardening electrode is said to embrace excellent arc characteristics, working equally as well with an ac or dc machine.

Following, according to maker, are the important properties: (1) No slag interference (2) rapid deposition rate (3) application in all positions (4) no loss of hardness or wear resistance on multiple layers (5) solid, dense deposits with an absolute minimum of porosity (6) satisfactory application within a wide range of amperages (7) easy slag removal while deposit is still red hot—slag is self-lifting when deposits cool (8) any desired bead may be applied including stringers, figure eights, crescents, weaving beads, etc. **Dept P, Air Reduction Sales Co, 60 E 42nd St, New York 17, N. Y.**



Induction Voltage Regulators

LINE OF DRY induction voltage regulators has been extended to include 300- and 600-v-amp ratings. New *Inductrols* are available in two designs: hand or motor operated for providing variable-output voltage from a relatively constant supply voltage and automatic for maintaining closely regulated output voltage from a varying supply voltage. Applications of *Inductrols* include motor-speed control, heat control of electric furnaces, illumination control, rectifier control, dielectric testing and instrument calibrating.

Losses are low as *Inductrols* operate at autotransformer efficiency and absence of brushes practically eliminates radio interference and cuts maintenance to a minimum. Wave-form distortion in most cases is nonexistent and units have practically no effect on power factor of circuit in which they are used. *Inductrols* are designed for continuous operation with a temperature rise not to exceed 55 C. **Dept P, General Electric Co, Schenectady 5, New York.**

Roller Thrust Bearing

NEW SPHERICAL roller thrust bearing combines high-load capacity, rolling alignment, ability to run at sustained high speeds and low friction.

By enlarging guide flange, and carrying it over center of roller, oil film is spread over a larger area. As a result, rollers are effectively separated from guide flange by an oil film that reduces friction to a minimum. Load-carrying capacity is limited only by what the rollers and raceways can endure, and heavy loads can be combined with high speeds.

A cage-retaining sleeve, pressed into bore of inner ring, provides a seat for bronze cage and makes a contained assembly of rollers, cage and inner race that is easy to mount. Tapered rollers are located at 45-deg angle to bearing bore. This enables bearing to carry not only heavy thrust loads, but also substantial radial loads.

Where load is predominantly thrust, as in vertical motors, vertical pumps, vertical generators, oil-well swivels and marine thrust blocks, only one roller thrust bearing is required instead of both a thrust and a radial bearing or several angular contact ball bearings in tandem.

It is expected that the spherical roller thrust bearing will considerably simplify design of air preheaters, centrifugals, deep-well pumps, motor-generator sets, oil-well swivels, rotary filters, turntables, motor turbines, waterwheels, wet and dry mixing pans, crane hooks, worm drives, reduction-gear units, etc. **Dept P, SKF Industries, Inc, Front St, Philadelphia 34, Pa.**

Blowdown Valves

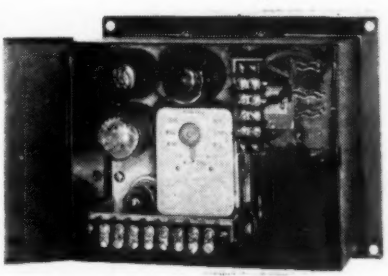
IMPROVED LINE of continuous boiler blowdown valves has following features: (1) Valve has unusually heavy design and extra thickness at all wear points. (2) Special flow-curved *Anum-Metl X* disk is for any seat for ⅛ in. to full valve size. *Anum-Metl X*, a special heat-treated alloy, has approximate Brinell surface hardness of 750 (*Rockwell* C 70). (3) There is a wide selection of seat sizes so valve may be accurately fitted to requirements. (4) Bolted body permits easily nonthreaded seat inspection or replacement. (5) Every valve is custom-sized at factory for job requirements.

Valve has a high pressure of 1500 psi, high temperature at 800 F and nonshock cold service to 6000 psi. **Dept P, Strong, Carlisle & Hammond Co, 1392 W 3rd St, Cleveland 13, O.**

Viscosity Meter

SYNCHRO-LECTRIC VISCOSIMETER provides an efficient method for making viscosity determinations in laboratory or industrial applications. Several models, each covering wide range of viscosities, are available. With multispeed models, each spindle has different range with every speed change. Model having seven spindles and four speeds has 28 ranges. Stock models are suitable for most research and control work. However, modifications may be made in standard models to suit practically any requirement.

Results are read in absolute viscosity units. Determinations can be made of non-Newtonian behavior. Instrument is easy to clean and requires no adjustment. It operates on principle of measurement of drag produced upon cylinder or disk rotating at definite constant speed while immersed in material under test. Synchronous motor assures unvarying speed. **Dept P, Brookfield Engrg Laboratories, Sharon, Mass.**

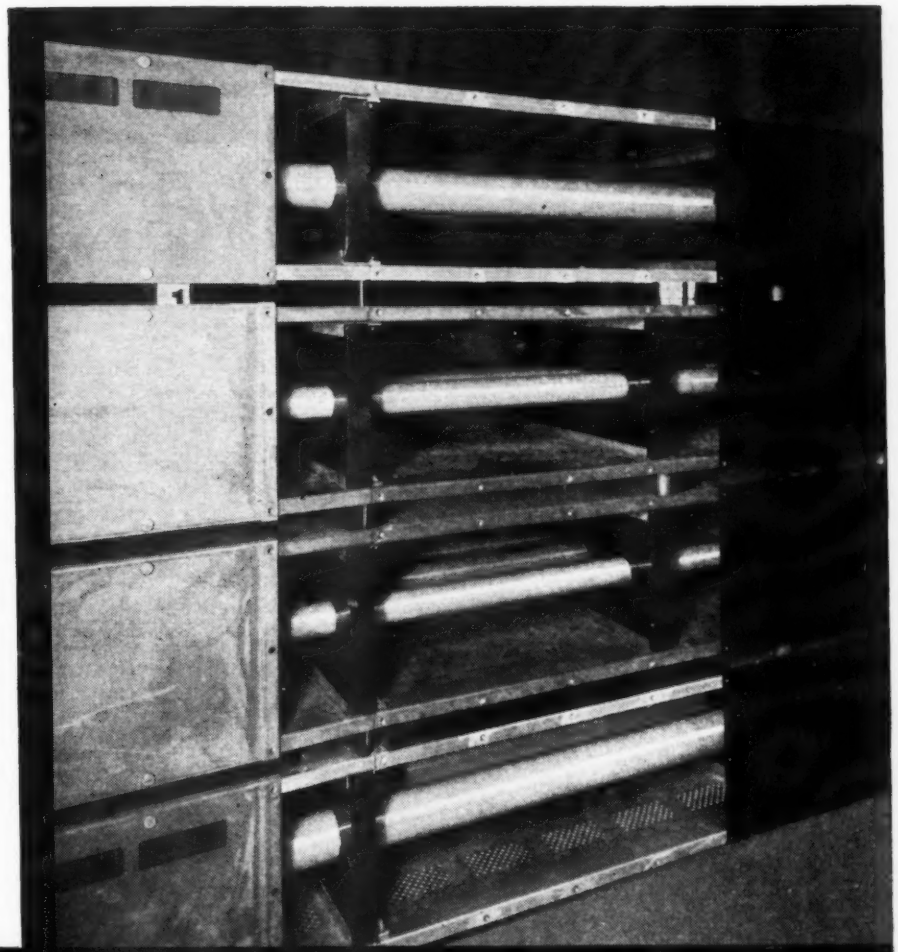


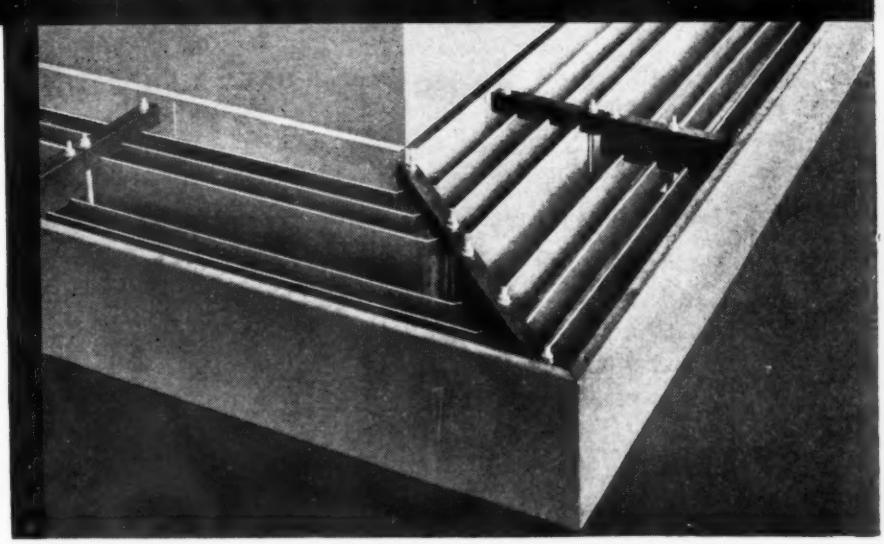
Limit Switch

ASHCROFT THERMAL PROTECTOR is a thermocouple-actuated limit switch. Operating knob inside case sets temperature chosen as the high limit. If this temperature is reached, the device stops apparatus before damage is excessive, or it can be arranged

POWER brings this monthly survey of new equipment as one of its many reader services. In requesting additional information from manufacturers, please identify the source of your inquiry by referring to Dept. P.

REVERE really knows BUS BAR





WHEN copper became a vital war metal because such large quantities of it were needed for ammunition and other top priority uses, Revere was asked if it could make bus bars out of pure silver. We said "YES!" even though processing of silver for such a purpose had never been attempted. By the end of the war, Revere had produced 36,000,000 pounds of silver bus for aluminum and magnesium plants.

Today, copper bus bar by Revere is back, in all the usual forms, rectangular, round, square, etc. When planning or remodeling an electrical installation, ask Revere to quote on your bus requirements. Other Revere products of interest to those generating or using electricity are condenser tubes and plates, specially-prepared switch copper, copper and brass pipe and tube, commutator bars.

REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Avenue, New York 17, N. Y.

Mills: Baltimore, Md.; Chicago, Ill.; Detroit, Mich.; New Bedford, Mass.; Rome, N. Y.
Sales Offices in principal cities, distributors everywhere.

Listen to *Exploring the Unknown* on the Mutual Network every Sunday evening, 9 to 9:30 p. m., EDST.

to sound an alarm or turn on a light. If desired, either or all of these functions can be performed at the same time.

In addition to protection from excessive temperature, device will "fail safe" in case of burning off or breaking of thermocouple, power-supply failure, tube or mercury switch. Further protection is provided by a manual reset. This makes certain that cause is corrected before equipment is damaged or production seriously interrupted.

Current characteristics are 115 to 230 v, 60 cycle, ac, 15 to 20 watts. There are no open contacts and circuit for signal and power input to the apparatus is a standard 4-amp 250-v mercury switch. **Dept P, Manning, Maxwell & Moore, Inc, Bridgeport 2, Conn.**

Combination Welder Control

CLASS 8992 COMBINATION CONTROL UNIT provides fully automatic control of air-operated resistance welding machines. A *Syncro-Break* welder contactor and *Safront* sequence-weld timer are both included in a single inclosure arranged to mount on right-hand side of machine with all control elements within easy reach of the operator.

Foot switch, pressure switch, no-weld switch and timer control circuits operate at 110 v and are isolated from power supply to give operator added safety. A metal barrier between contactor and timer sections of inclosure eliminates possibility of flash-over between power and control cricuits.

Combination controllers are designed with a control circuit which may be either separate or common with power circuit. Solenoid air valve may be energized from either power- or control-supply sources by simple reconnection. Standard controllers have tapped primary-control transformers, which can be connected for operation at 110, 220 or 440 v, 60 cycles; or for 380 v, 50 cycles. Other voltages and frequencies are available on special order.

Space and terminals are provided within the standard controllers for additional features such as 24-v initiating switch control, 2-stage pilot-switch control. **Dept P, Square D Co, 4041 N Richards St, Milwaukee 12, Wis.**

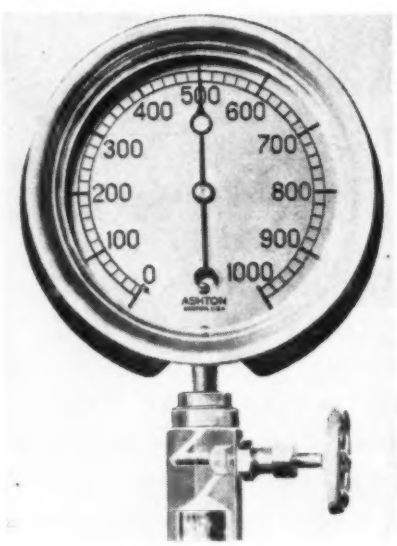
Air Circulators

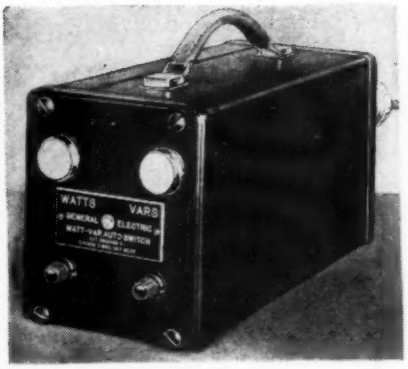
ROTO-BEAM is said to employ a newly discovered aerodynamic principle in shape of the revolving blades. This is claimed to cause a 2-way pulsating circulation of air at all levels. Industrial and home sizes will be produced, including pedestal-base commercial models. **Dept P, Climax Engrg Co, Clinton, Iowa.**

Pulsation Dampener

IMPROVED MICRO-BEAN is now available both in all brass and all steel with stainless-steel stem. No piston is required. Temperature has no effect on viscosity and surface tension of liquids within the line. New model overcomes the scoring problem. A screw is provided which, when turned slightly, will bring back the seating to perfect control. This can be repeated every two years or so, giving the device long life. When the micro-plug eventually becomes scored up, scores can be eradicated by merely opening and closing the valve tightly about ten times. Principal purpose of *Micro-Bean* is to eliminate "jitters" in gages.

Micro-Bean is in three IPS sizes (female connections on each end) $\frac{1}{4}$, $\frac{3}{8}$ and $\frac{1}{2}$ in., for pressures up to 6000 psi. It can serve on any gage line to boilers, engines, pumps, compressors, etc. **Dept P, J A Campbell Co, 645 E Wardlow Rd. Long Beach 7, California.**





Watt-Var Autoswitch

FOR CENTRAL STATIONS, industrial-plant substations and similar applications, watt-var autoswitch checks load lines to determine whether additional power-factor correction is needed. Autoswitch permits recording of both watts and vars on a single instrument. This device (with an associated recorder) gives direct information on amount of corrective kva needed and at same time records the power component, in kw. Watts and vars appear on same chart with a slight difference in density, depending on setting of timer inside autoswitch. A typical installation consists of an inkless recording wattmeter, watt-var autoswitch, and suitable current and potential transformers.

Watt-var autoswitch consists of two autotransformers, a time switch, two double-pole double-throw relays, fuses, indicator lamps and connectors for outgoing cables. Time switch automatically connects instrument potential circuits directly to potential transformers to record watts and to phase-shifting autotransformers so that instrument will record vars. Transfer is rapid, continual, and at predetermined intervals. It is applicable only to the inkless recorder that produces a record by a series of dots on paper. **Dept P, General Electric Co, Schenectady 5, N. Y.**

Refrigerant-Gas Condenser

FOR CONDENSING refrigerant gases with automatic year-around operation, Niagara *Aero-Pass* condenser consists of two condensing coils, the first of which is a dry coil (the Niagara *Duo-Pass*) in which temperature of gas is reduced close to condensation point. Second coil is sprayed with water, which, as it is evaporated in a fan-induced air stream, reduces gas temperature by 1000 Btu per lb of water evaporated and causes condensing of refrigerant. Water is recirculated and only amount evaporated is consumed.

To this is added the Niagara balanced wet-bulb control. Through a recirculating duct a varying amount of air stream is diverted under automatic control as is necessary to obtain always full condensing

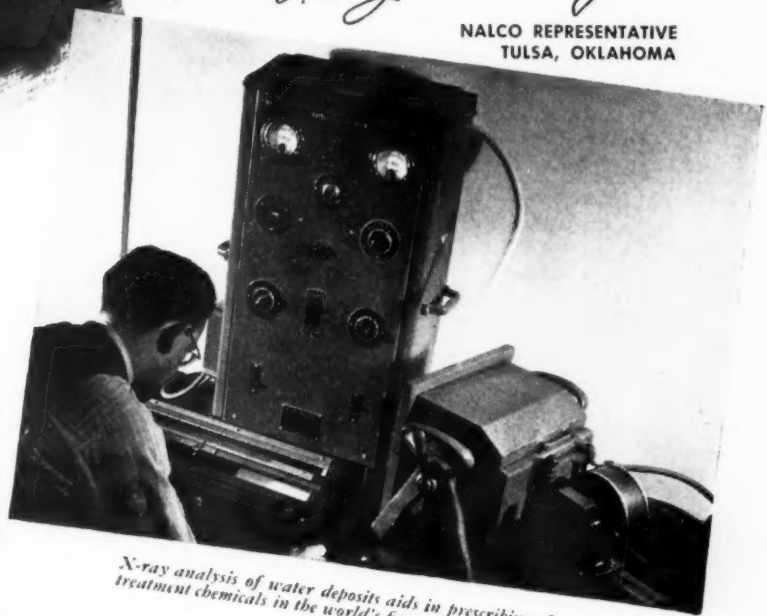
(*Continued on page* 166)

POWER brings this monthly survey of new equipment as one of its many reader services. In requesting additional information from manufacturers, please identify the source of your inquiry by referring to Dept. P.

more than 250,000 water treatment jobs to do!

says: *C. E. Jennings*

NALCO REPRESENTATIVE
TULSA, OKLAHOMA



X-ray analysis of water deposits aids in prescribing the right water treatment chemicals in the world's finest water treatment laboratories.

OVER a quarter-million water treatment service jobs in the United States alone sounds like a huge order. Yet, for best boiler performance and lowest maintenance and repair costs, *every* steam generating unit needs the advantages of thorough, made-to-order water treatment . . . No two plants have precisely the same water and operating conditions, so individualized water treatment is the obvious answer wherever steam generation costs are a factor.

Nalco offers such a service . . . For large and small plants . . . High or low pressures . . . And Nalco's *only* business is water treatment. Details on a complete water treatment survey and recommendations for your plant sent on request.

Nalco

NATIONAL ALUMINATE CORPORATION

6222 West 66th Place • Chicago 38, Illinois

Canadian inquiries should be addressed to:
Aluminate Chemicals, Ltd., 555 Eastern Avenue, Toronto, Ontario.

THE SCIENTIFIC WATER TREATMENT SYSTEM FOR ALL INDUSTRY

How to plan a DEAERATING FEEDWATER HEATER SYSTEM

Another in the series of basic Piping Layouts prepared by Jenkins Bros.

To prevent corrosion of boiler tubes in all plants generating steam for power, it is necessary to deaerate feedwater. To avoid cold water shock that shortens boiler life, feedwater must also be treated.

A common combination of deaeration and heating is effected in a feedwater heater as shown in the diagram. Here a vent condenser is superimposed to help maintain a little pressure in the heater, producing higher temperatures and consequent better deaeration. In addition, the vapors, which would represent waste heat, are condensed by either cold make-up water or a mixture of make-up water and condensate. Condensate or make-up water may enter either directly into heater or through the vent condenser. Normal operation usually puts water through the make-up condenser, utilizing the automatic level controller. Uncontrolled condensate is returned directly into the heater. Thus make-up water replenishes natural losses in the condensate system and evaporation losses in the heater.

To maintain deaeration, live steam must be added in the condensate system to keep water temperature at some predetermined value. This compensates for addition of cold make-up water and normal heat losses. The overflow loop and seal allows for overflow if and when surges occur, and prevents reentry of air.

All valves used for regulation are shown as Globes, while shutoff valves around automatic valves are Gates. The drain from heater is a rising spindle bronze Gate for the rugged service of handling sludge as well as water, and to show when the valve is fully closed. All valves are bronze, except the large condensate Globe and check valves which are iron-body, bronze-mounted, because they are not subject to pressure.

Jenkins PRACTICAL PIPING LAYOUTS

Illustrating the proved 3-point formula for trouble-free, time-defying hookups

A Use the right type valve for the service.
B Place valves correctly in the line.
C Choose Jenkins Valves for lifetime economy.

14

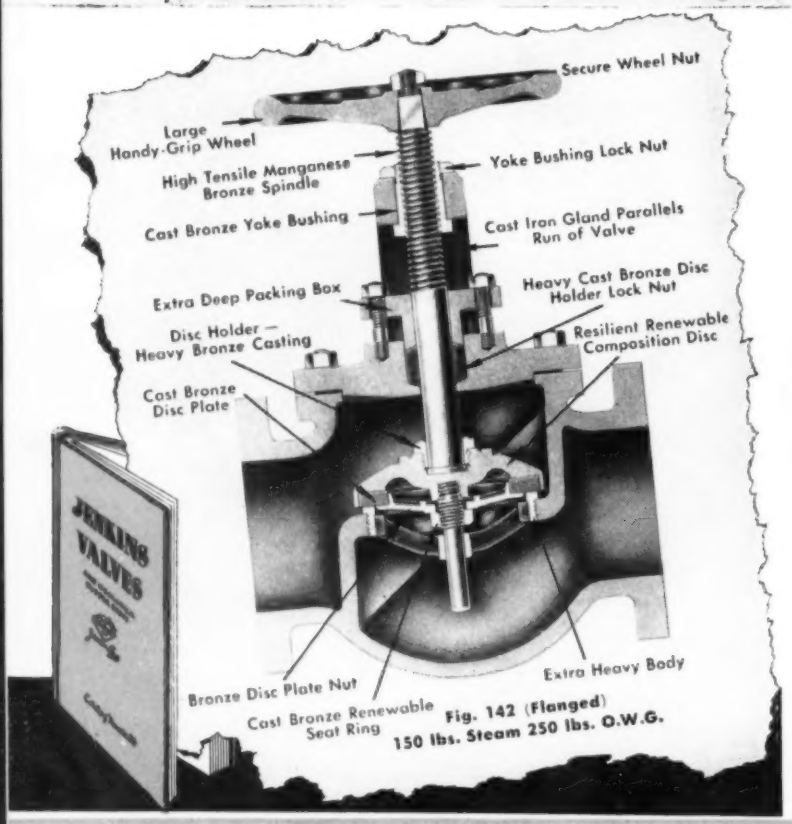

Secure Wheel Nut
Large Handy-Grip Wheel
High Tensile Manganese Bronze Spindle
Yoke Bushing Lock Nut
Cast Bronze Yoke Bushing
Cast Iron Gland Parallels Run of Valve
Extra Deep Packing Box
Heavy Cast Bronze Disc Holder Lock Nut
Disc Holder — Heavy Bronze Casting
Resilient Renewable Composition Disc
Cast Bronze Disc Plate
JENKINS VALVES
Extra Heavy Body
Bronze Disc Plate Nut
Cast Bronze Renewable Seat Ring

Fig. 142 (Flanged) 150 lbs. Steam 250 lbs. O.W.G.

Many types and Pressure Ranges of Jenkins Valves can be used for this type of layout according to the factors involved. Consultation with accredited piping engineers and contractors is recommended when adapting these suggestions to your own requirements, or when planning any major piping installation.

Copies of Layout No. 14 will be furnished on request . . . also copies of future Piping Layouts. Just mail coupon.

Fig. 142 Iron Body Globe Valve, O.S.&Y., with Renewable Bronze Seat Ring and Composition Disc, is used for control of steam, fluids and gases where drop-tight closure is essential. The resilient composition disc assures tight closure with least effort, and can be replaced quickly and economically without removing valve from line. Body is semi-steel with average tensile strength of 34,000 lbs. p.s.i., exceeding ASTM standards.

A CHOICE OF OVER 600 JENKINS VALVES

To save time, to simplify planning, to get the advantage of Jenkins specialized valve-engineering experience, — select all the valves you need from the Jenkins line, fully described in the Jenkins Catalog No. 76. It's your best assurance of *the lowest cost in the long run.*

Jenkins Bros., 80 White Street, New York 13; Bridgeport; Atlanta; Boston; Philadelphia; Chicago; Jenkins Bros., Ltd., Montreal; London, England.

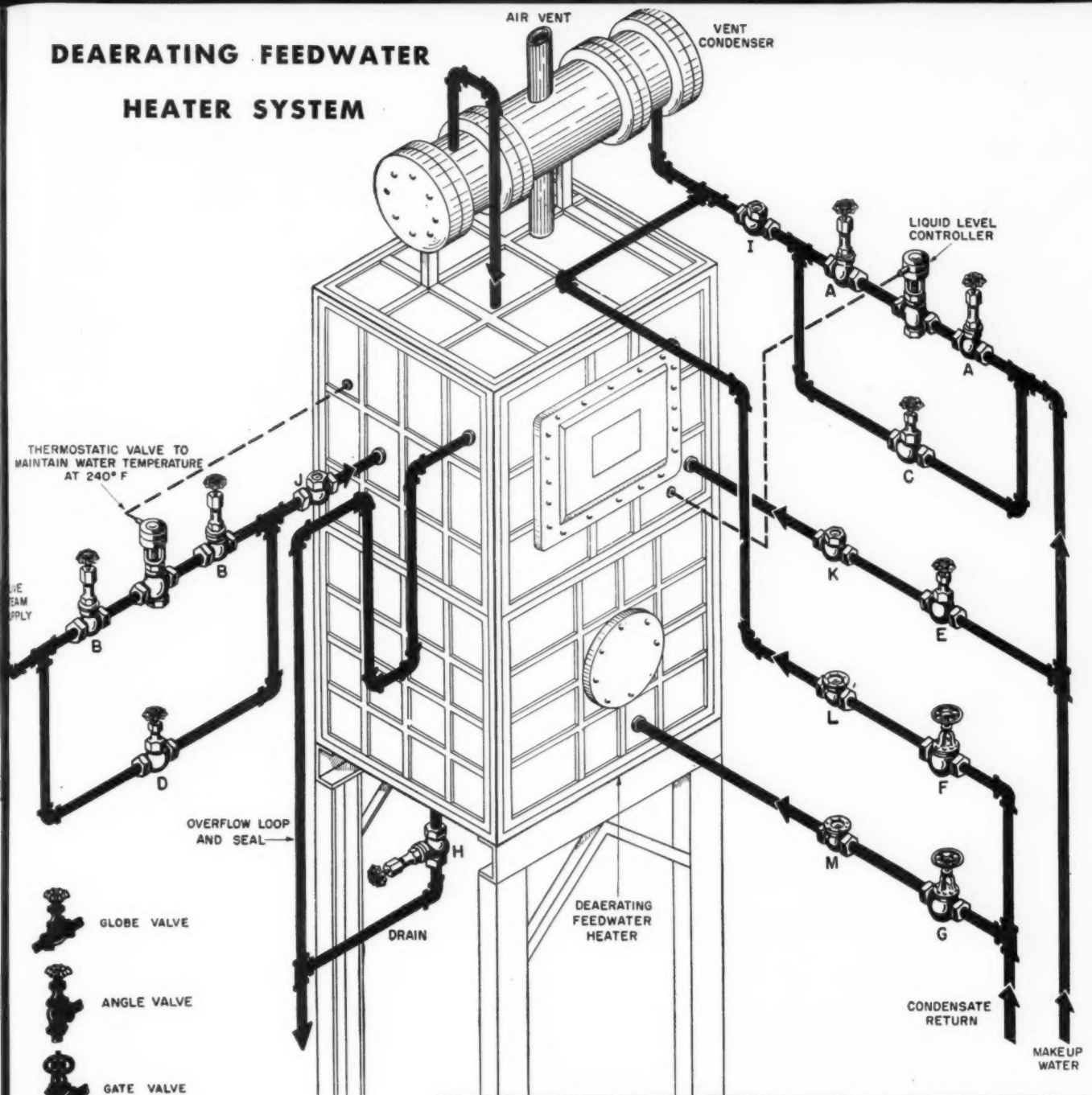
JENKINS VALVES

LOOK FOR THE DIAMOND MARK
SINCE 1864

125 TO 600 LBS. STEAM PRESSURE

Jenkins Bros

DEAERATING FEEDWATER HEATER SYSTEM



GLOBE VALVE

ANGLE VALVE

GATE VALVE

CHECK VALVE

PRESSURE GAGE

THERMOMETER

Code	Quan.	Jenkins Valves	Service
A	2	Fig. 47 Bronze Gate	Liquid Level Controller Shut-off
B	2	Fig. 47 Bronze Gate	Thermostatic Valve Shut-off
C	1	Fig. 106A Bronze Globe	Makeup Water thru Vent Condenser By-pass
D	1	Fig. 106A Bronze Globe	Live Steam Heating Makeup By-pass
E	1	Fig. 106A Bronze Globe	Makeup Water Direct to Heater
F	1	Fig. 141 IBBM Globe	Condensate Return thru Vent Condenser
G	1	Fig. 141 IBBM Globe	Condensate Return Direct to Heater
H	1	Fig. 47 Bronze Gate	Heater Drain and Clean Out
I	1	Fig. 117A Bronze Lift Check	Makeup Water thru Vent Condenser
J	1	Fig. 117A Bronze Lift Check	Live Steam Heating Makeup
K	1	Fig. 117A Bronze Lift Check	Makeup Water Direct to Heater
L	1	Fig. 623 IBBM Swing Check	Condensate Return thru Vent Condenser
M	1	Fig. 623 IBBM Swing Check	Condensate Return Direct to Heater

VALVE RECOMMENDATIONS

For details – and valves to suit varying conditions – see Jenkins Catalog

Diagram by Huxley Madeheim, Consulting Engineer

BRONZE ★ IRON ★ STEEL

FOR EVERY INDUSTRIAL, ENGINEERING, MARINE, PLUMBING-HEATING SERVICE

SOLD THROUGH RELIABLE INDUSTRIAL DISTRIBUTORS EVERYWHERE

JENKINS BROS., 80 White St., New York 13, N. Y.

Please send me a reprint of Piping Layout No. 14 and future Layouts as they become available.

Name .....

Company .....

Address .....

.....

Number 169

Estimated Turbine Steam Rates

For 60-cycle, condensing turbine-generator sets

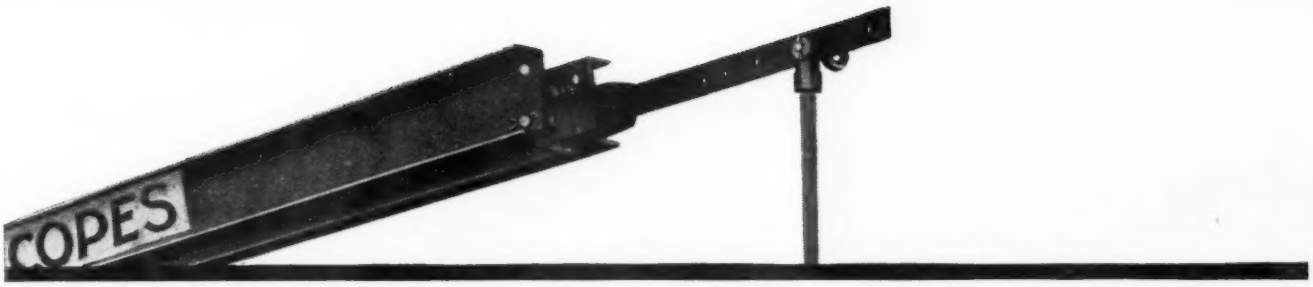
500- to 1500-kw sets

2000- to 7500-kw sets

By L E Newman, General Electric Co

Republication rights reserved by author.

© POWER

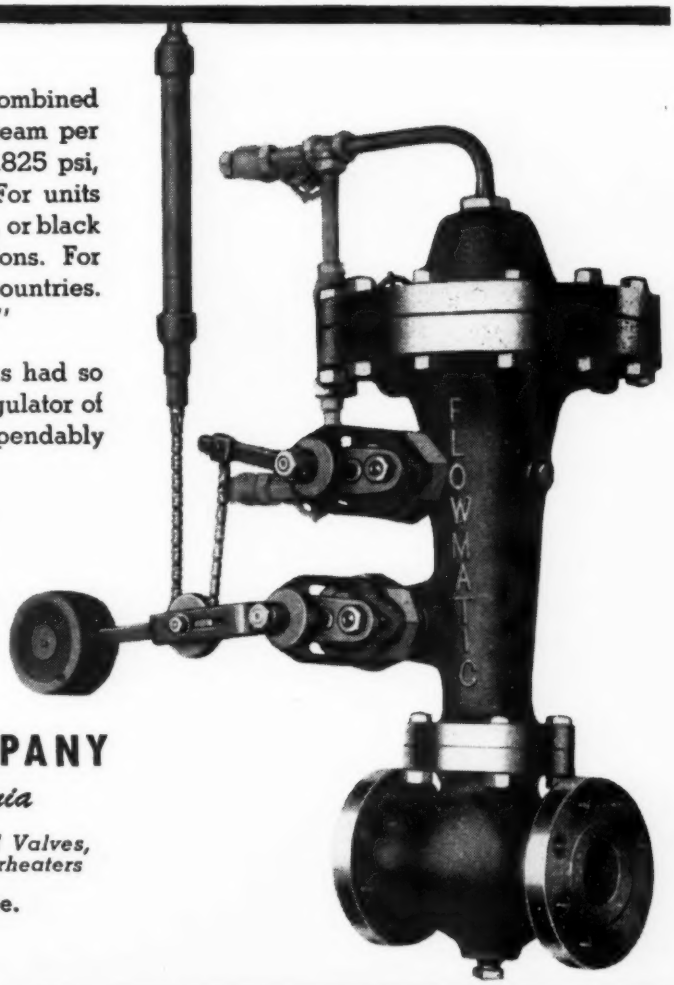


237,263,950
pounds per hour

COPES Flowmatic has now been ordered for a combined boiler capacity in excess of 237 million pounds of steam per hour. For 32 makes of boilers, at pressures up to 1825 psi, with evaporation up to 650,000 pounds an hour. For units fired by pulverized coal, stokers, gas, oil, acid sludge, or black liquor; for waste-heat and "cat cracker" installations. For plants in 43 states, two territories and 21 other countries. Four out of ten orders received have been "repeats."

No other multiple-element feed water regulator has had so wide a range of operating experience. No other regulator of the steam-flow type has proved so easy to keep in dependably accurate operation.

If you would like to know where to check on results with COPES Flowmatic, write for the bulletin — "455 Users." If you want thoroughly modern feed water control for your plant, outline your operating conditions in detail when you write.



NORTHERN EQUIPMENT COMPANY

961 Grove Drive, Erie, Pennsylvania

Feed Water Regulators, Pump Governors, Differential Valves, Liquid Level Controls, Reducing Valves and Desuperheaters

BRANCH PLANTS: Canada, England, France.

Representatives Everywhere

★ **GET CLOSER LEVEL CONTROL WITH THE** COPES FLOWMATIC ★ REGULATOR

FEEDS BOILER ACCORDING TO STEAM FLOW-AUTOMATICALLY

Engineerproof . . .

We frequently hear of "foolproof" designs and procedures for preventing power-plant or industrial accidents in general — yet accidents go right on happening.

I maintain that many of our designs and procedures are "engineerproof," *but not foolproof*. There's quite a difference, as I think the following examples will show you.

Like many others, one big utility station I know has its high-tension gear in locked compartments protected by interlocks. Anyone planning to enter a compartment must first go through as many as six successive steps, grounding conductors, locking switches open, etc, each step releasing a key to unlock the next. The final step releases a key to unlock the compartment, within which everything is now safe to handle. Busses and disconnects outside the compartments are so arranged that they cannot be reached from the floor. The rule is simple — keep your feet on the ground and you can't get hurt.

It looks foolproof — but, one Sunday, a janitor carried a ladder into the area and started to clean some disconnects. At least that's what they figured he did after they got him scraped off and normal service restored. Every engineer and operator knew that to be safe he must keep his feet on the ground. But the janitor — who didn't or forgot — was just as dead as if there'd been no safety precautions.

One plant reamed tubes of vertical boilers in its locomotive crane with an air motor, pipe-extension sleeve and reamer. This assembly was moved up and down by hand, from the crane-cab roof. The operator, after carefully cautioning his helper not to touch the control handle, walked away, leaving the air motor waist high above the tubes. When he came back, his helper lay on the ground with a broken shoulder and several broken ribs. He had leaned on the wrong handle, started the motor and been thrown off.

Most electrical maintenance work is protected by use of the "hold-off tag" system, but this can go wrong, too, although it seems airtight. A feeder was to be repaired at a substation. The man on the board cut it out and tagged it in accordance with safety instructions. Then the maintenance man went to work — *on the feeder next to it*. The next step was a stretcher.

Again, an air circuit breaker was to be installed. The operator opened the circuit and tagged it with the prescribed huge red tag, which could not be removed and the circuit closed until the repairman cleared with the operator, signifying the job as complete. Several hours later, just as the repairman and helper had finished and were picking up their tools, the breaker went in. Gray around the gills, they went to the board; the switch, still properly tagged, was closed. The operator finally recollected that he'd closed it — *hadn't even seen the tag.*

These "impossible" accidents happened in spite of intensive safety campaigns by skilled engineers. Each installation or procedure was engineerproof — but *not foolproof*. Some will say that the remedy is not to employ fools — a Utopian idea if I ever heard of one, for even the most cautious of us has his foolish moments.

The only sound policy in safety work is to assume that *every* operator and engineer will be a fool at times. Under such an assumption, one foolish moment may not be a man's last moment on earth.

George Edwards
Engineer

In Insulations too . . .

IT HAS TO BE RIGHT THE FIRST TIME

—and time has proved J-M 85% Magnesia right for lasting insulating efficiency

For more than fifty years, the right combination of physical and thermal properties has made J-M 85% Magnesia the standard of industry. It is light in weight, uniform in composition. Properly applied it can outlast the installation it covers. It comes in pipe-covering form and in straight or curved blocks easily adapted to flat or rounded surfaces.

Expert Application of the Right Insulation

You can rely on the skill and experience of Johns-Manville Insulation Applicators. These specialists select materials of the correct thickness and size from the complete line of J-M Industrial Insulations. Their skilled mechanics use the most modern application methods to assure you the greatest economy of installation. And, back of the J-M Insulation Applicators are Johns-Manville's 88 years of service in this field.

For complete details on J-M insulations, and answers to special problems, write Johns-Manville, Box 290, New York 16, New York.

JOHNS-MANVILLE PRODUCTS

JOHNS-MANVILLE *First in* INSULATIONS

FOR THE ENGINEER'S BOOKSHELF

BOOKS REVIEWED IN THIS ISSUE

SWITCHBOARDS AND PANELBOARDS • BUILDERS FOR BATTLE
APPLICATIONS VOLUME: REFRIGERATING DATA BOOK
INDUSTRIAL ELECTRIC CONTROL • ELECTRONS IN ACTION
THE ENGINEER IN SOCIETY • ELECTRONICS IN INDUSTRY
INDUSTRIAL ELECTRICAL HEATING AND ELECTRICAL FURNACES
BUSINESS JOURNALISM: ITS FUNCTION AND FUTURE
STEAM POWER PLANT AUXILIARIES AND ACCESSORIES • BOOKLETS

Refrigeration Data Book

APPLICATIONS VOLUME: REFRIGERATING DATA BOOK, *2nd edition.* 873 *pp,* 6¼x9, *numerous illust, cloth.* $5. *The American Society of Refrigerating Engineers,* 40 *W* 40 *St, New York, N. Y.*

A completely revised and, in some instances, rewritten volume deals with refrigeration applications. Each chapter is devoted to a specific application and describes the processes involved, beginning with fundamental principles.

The data represent the combined efforts of a large number of refrigerating engineers, each one fully capable of handling the subject assigned him.

Classified section, 190 pages, contains a list of refrigerating equipment products and their respective manufacturers. List is subdivided and cross-indexed for quick reference. Section also contains a list of manufacturers who make component parts and accessories for refrigerating systems.

Pacific Construction Job

BUILDERS FOR BATTLE (1946) *By David O Woodbury.* 415 *pp,* 7x10, *illust, cloth.* $7.50. *E P Dutton & Co,* 300 *4th Ave, New York* 10, *N. Y.*

Most books on the war present, as well they may, the dramatic and heroic accomplishments of our armed forces. This one tells the story of the gigantic tasks done by American civilian contractors, engineers and workmen in the Pacific. Bases, built by these organizations in the Hawaiians, Midway, Johnston, Palmyra, Samoa and other islands, represent the greatest single construction contract in world history, in cost, diversity of character and dispersion over great areas.

These bases involved the construction of 270 million cu ft of building space and the excavation of 50 million cu yd of earth and coral. From them the now famous Seabees started building the life lines for the battle of the Far East, and from them our armed forces began their westward march to victory.

Those who have read "The Colorado Conquest" and "The Glass Giant of Palomar" are familiar with the author's inimitable knack of presenting engineering subjects in a lucid and entertaining style. Although *Builders for Battle* is his toughest assignment, it is one of his best works. In it engineers will find much to make them proud of their profession, and they and laymen will learn a lot about what occurred in the Pacific behind the curtain of secrecy before Pearl Harbor and after.

Civil Role for Engineers

THE ENGINEER IN SOCIETY (1946) *By John Mills, retired director of publications at the Bell Telephone Laboratories.* 196 *pp,* 5½x8, *cloth.* $2.50. *D Van Nostrand Co, Inc, New York, N. Y.*

The author, who has had a lifelong feeling that an engineer is too self-effacing, endeavors to stimulate him to more active social awareness by presenting many interesting sidelights on employment and life in modern technical concerns.

An opening chapter on basic differences in thought processes, which stamp a man as falling in one of two major groups, makes the reader test himself unconsciously. From there on, through a chapter on the wrong man for the right job into one on engineering aptitudes, the book exerts a strong personal appeal.

The author points up the research man's job, and develops his gradual changeover under present-day rating for progress along the line of organization. This method of rating, from the author's viewpoint, is a major defect in the business world. Research offers the hope and strength of our economy, and to siphon off its competents is a serious national abuse of important wealth.

His recommended course of remedy offers as its wellspring the transfer of scientific, engineering know-how to the more social phases of our economy. Engineers must make and support all such efforts as a body and not as individuals. He feels that an unfortunate sidelight of recognition today is that it heeds only the voice of an organized group and never notices the inarticulate individual.

Electrical Heating

INDUSTRIAL ELECTRICAL HEATING AND ELECTRICAL FURNACES (1945) *By E S Lincoln, consulting engineer.* 192 *pp,* 8½x5½, 62 *illust, cloth.* $3.00. *Duell, Sloan & Pearce, Inc,* 270 *Madison Ave, New York* 16, *N. Y.*

A thorough review and discussion of an industrial operating tool profits from the author's previously demonstrated practical approach. Opening chapters serve to introduce the reader to the major advantages of electric heating and the selection of metals and forms of metals best suited for heating duty.

The author builds on this background by discussing equipment and its applications as well as types of heating units. His next major group is electrically operated steam generators, their applications and efficiency. A third major division similarly treated is electric ovens and driers.

Remaining material covers electric furnaces and, again, the author ties together a fund of information with an exhaustive detailing of types, general design, lining, construction elements, advantages and uses as well as controls. A recent highly publicized industrial tool, the high-frequency induction furnace, also comes in for operating discussion.

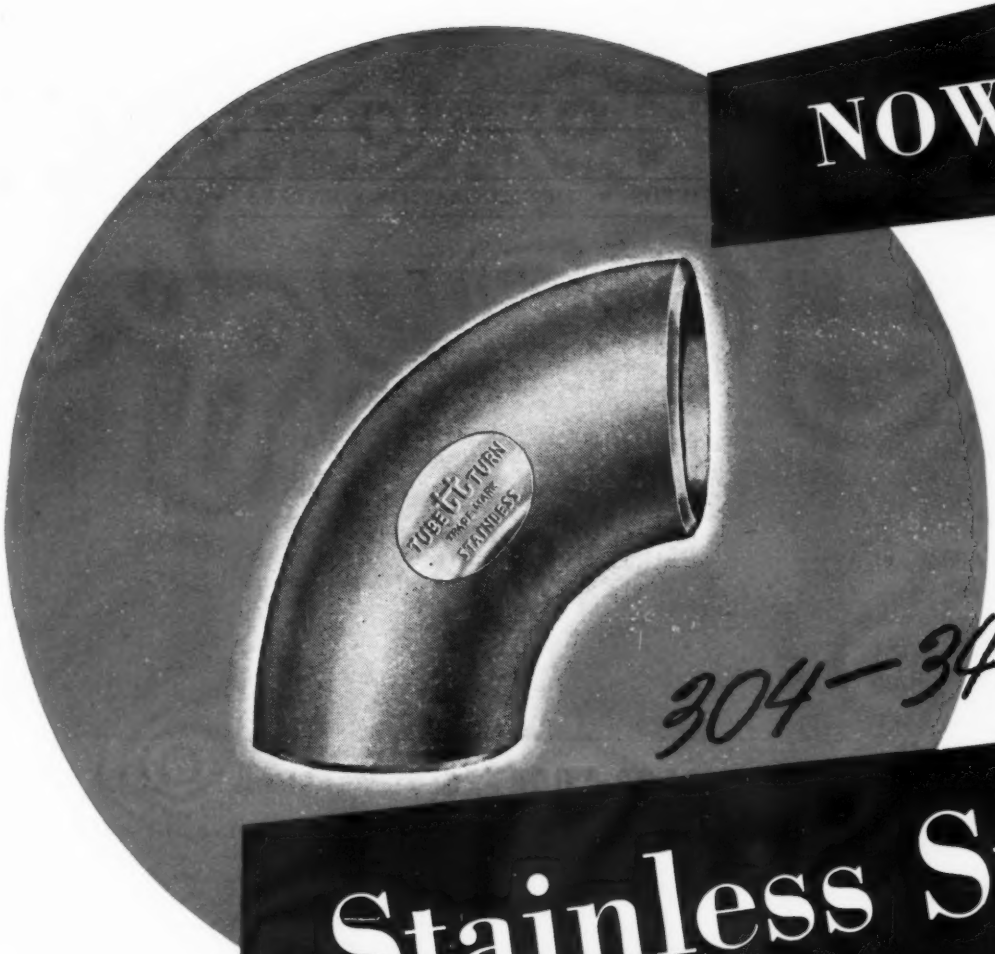
Electric Control

INDUSTRIAL ELECTRIC CONTROL (1945) *By E S Lincoln, consulting engineer.* 374 *pp,* 8½x5½, 243 *illust, cloth.* $3.00. *Duell, Sloan & Pearce, Inc.* 270 *Madison Ave, New York* 16, *N. Y.*

A compilation under the major divisions of electric control, resistance, reactance, electronic and switching, constitutes a ready study source for student or operator. The many types and their limitations, as interpreted by National Electrical Code, are discussed with the viewpoint of establishing their function and selecting the type best fitted for this service.

Special chapters on switches, resistance-control devices, and relays fit into this scheme of tying the material directly into NEC specifications. Also valuable is a listing of relay definitions by National Electrical Manufacturers Assn. Further special treatment covers motor controls, timing devices, temperature control and electronic

(*Continued on page* 160)



NOW!

304-347-316

Stainless Steel

TUBE-TURN WELDING FITTINGS

TRADE MARK

. . . now available, including 45°, 90° and 180° elbows, tees, caps, reducers, lap joint stub ends. Write for the name of your nearest distributor. Return the coupon for new bulletin giving full information on Tube-Turn Stainless Steel Welding Fittings.

TUBE TURNS (Inc.), Louisville 1, Kentucky. District Offices: New York, Washington, D. C., Philadelphia, Pittsburgh, Cleveland, Detroit, Chicago, Houston, San Francisco, Seattle, Los Angeles.

tt

TUBE TURNS, Inc., LOUISVILLE 1, KENTUCKY
Please send new bulletin on Tube-Turn Stainless Steel Welding Fittings.

Name.....

Title.....

Firm Name.....

Address.....

2709

POWER NEWS

BUSINESS ITEMS AND APPOINTMENTS • WASHINGTON NOTES

FOREIGN FIELDS • MODERNIZATION POINTERS • CONVENTIONS

Directors Reveal Plans For Atomic Pilot Plant

► MANHATTAN DISTRICT'S atomic-electric plant is about two years away from operation, it was learned from directors of the project that was begun last April at Oak Ridge, Tenn.

The pilot plant for nuclear power will be pushed to completion as rapidly as possible, said Dr James H Lum, executive director of Clinton Laboratory at Oak Ridge. Numerous experiments, which must be made before settling on final design, will probably consume all of 1946 and part of 1947. Difficulties of procuring equipment of this special category will probably delay starting the final pilot plant until 1948.

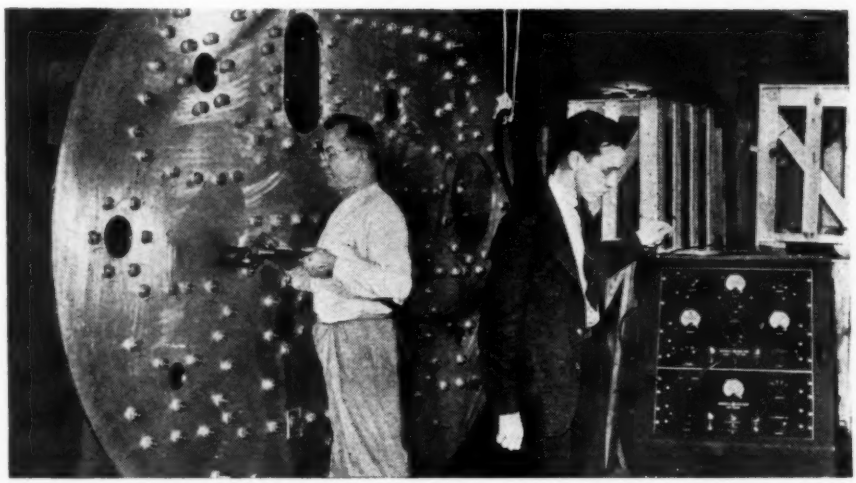
Considerable emphasis will be laid, during plant design and construction, upon achieving a heat source of long life and great reliability. These attributes are of particular importance because of radioactivity, which renders any pile, once operated, difficult and dangerous to shut down for repair or maintenance. In addition, radioactivity requires heavy shielding of the pile, which also makes it desirable to avoid as much as possible any non-operational work on the pile once it has operated.

First operation of the pile will be to derive heat energy for steam-electric generation. The plant is being designed to operate at conventional central-station temperature levels, which range from 650 to 940 F.

When problems of harnessing nuclear reactors for steam-electric generation have been solved, it is expected that the project will be broadened to test such additional heat-transfer agents as mercury vapor and various gases. Unconventional heat levels may also be attempted.

It was indicated that the only limit on temperatures that will circumscribe the project will arise from ability of construction materials used in the pile to withstand heat. It is not anticipated that any limitation will be placed on the design because of fears that too great a temperature might induce unsafe reactions in the fissionable material whence the heat is derived.

(*Continued on page* 188)



DETECTOR LOCATES COVER-PLATE LEAKS

A General Electric leak detector, normally used to detect one part of helium in 200,000 parts of air in vacuum systems, has recently tested three new aluminum transformer cover plates for leaks. General Electric engineers worked with the Consolidated Edison Co of New York on this application. There were 177 studs through each plate and each stud had to be tested for oil tightness

COMING EVENTS

Sept 10-14—Fourth National Chemical Exposition, Coliseum, Chicago, Chicago section, American Chemical Society, Marcus W Hinson, 330 S Wells St, Chicago, Ill.

Sept 16-18—Meeting, Wm Penn Hotel, Pittsburgh. Industrial Instruments & Regulators Div, ASME, E W Jacobson, c/o Gulf Research & Development Co, Pittsburgh 30, Pa.

Sept 16-20—First National Instrument Conference & Exhibit, Wm Penn Hotel, Pittsburgh. Instrument Society of America, Richard Rimbach, exec secy, 1117 Wolfendale St, Pittsburgh 12, Pa.

Sept 30-Oct 2—Fall meeting, Hotel Statler, Boston. Boston sec, ASME, Harold King, c/o General Electric Co, Lynn, Mass.

Oct 1-4—Meeting, Public Auditorium, Cleveland. Association of Iron & Steel Engineers, John B Harmon, 1010 Empire Bldg, Pittsburgh 22, Pa.

Oct 3-5—National Electronics Conference & Exhibit, Edgewater Beach Hotel, Chicago. National Electronics Conference Publicity Committee, C A Emery, 20 N Wacker Dr, Chicago 6, Ill.

Oct 24-26—Joint meeting, Bellevue-Stratford Hotel, Philadelphia. Fuels Div of ASME and Coal Div of AIME, N E Funk, c/o Philadelphia Electric Co, Philadelphia, Pa.

Oct 28-30—Seventh Annual Water Conference, William Penn Hotel, Pittsburgh, Pa. Engineers' Society of Western Pennsylvania, K F Treschow, secretary, William Penn Hotel, Pittsburgh, Pennsylvania.

Oct 29-Nov 1—All-Industry Refrigeration Show, Public Auditorium, Cleveland. Refrigeration Equipment Manufacturers Association, R Kennedy Hanson, secretary, 1107 Clark Building, Pittsburgh, Pennsylvania.

Nov 18-22—National Metal Exposition, Municipal Auditorium, Atlantic City, N. J. Chester L Wells, 7301 Euclid Ave, Cleveland 3, O. Following are holding annual meetings in Atlantic City at same time: American Society for Metals, Traymore Hotel (headquarters); Iron & Steel Div and Institute of Metals Div, American Institute of Mining & Metallurgical Engineers, at Claridge Hotel; American Welding Society, at Ambassador Hotel.

STOP THE SLAMMING

and you'll cut maintenance costs!

CHAPMAN CHECK VALVES

TILTING DISK

Slamming jars pipelines, starts surging and opens up joints, thus necessitating high maintenance costs. The Chapman Tilting Disc Check Valve employs a balanced hinge-pinned disc which rides evenly in the flow when the valve is open and cushions quietly to a drop-tight seat when the flow slows down.

Experience has proved that Chapman Tilting Disc Check Valves invariably save from 65% to 80% in head losses over conventional type check valves.

Chapman Tilting Disc Check Valves are made in iron and steel.

Send for free engineering data and reports of tests.

The Chapman Valve Manufacturing Company

INDIAN ORCHARD, MASSACHUSETTS

For business EFFICIENCY

cash in on the money-making speed of AIR EXPRESS

NOW! THE LID IS OFF! MORE PLANES, MORE FLIGHTS — FOR EVERYBODY PRIORITIES NO LONGER NEEDED!

When you need something *now* to keep your business going, machinery running, men at work, or to plug up holes in your inventory — specify Air Express and get it the fastest way.

No supplier in the country is far away from your door — by air. A matter of flying hours — overnight at the most.

Cost? Rates are drastically down. But aside from this new economy, Air Express is a money-making tool used by thousands of firms for increased business efficiency.

Specify Air Express-a Good Business Buy

Shipments go everywhere at the speed of flight between principal U. S. towns and cities, with cost including special pick-up and delivery. Same-day delivery between many airport towns and cities. Fastest air-rail service to and from 23,000 off-airline communities in the United States. Service direct by air to and from scores of foreign countries in the world's best planes, giving the world's best service.

RATES CUT 22% SINCE 1943 (U. S. A.)					
AIR MILES	2 lbs.	5 lbs.	25 lbs.	40 lbs.	Over 40 lbs. Cents per lb.
149	$1.00	$1.00	$1.00	$1.23	3.07c
349	1.02	1.18	2.30	3.68	9.21c
549	1.07	1.42	3.84	6.14	15.35c
1049	1.17	1.98	7.68	12.28	30.70c
2349	1.45	3.53	17.65	28.24	70.61c
Over 2350	1.47	3.68	18.42	29.47	73.68c
INTERNATIONAL RATES ALSO REDUCED					

AIR EXPRESS

AIR EXPRESS

GETS THERE FIRST

Write Today for the Time and Rate Schedule on Air Express. It contains illuminating facts to help you solve many a shipping problem. Air Express Division, Railway Express Agency, 230 Park Avenue, New York 17. Or ask for it at any Airline or Railway Express office.

Phone AIR EXPRESS DIVISION, RAILWAY EXPRESS AGENCY
Representing the AIRLINES of the United States

Pump Q & A

(*Continued from page* 124)

ing as both a steam and an exhaust port, some distance from the cylinder's end. A much smaller port extends from the main port, or from the steam chest, to the counterbores at the cylinder's ends. After the steam piston cuts off the main port, the trapped steam forming the cushion leaks off through this small port as the piston advances to the point where the steam valve reversal takes place. It is not necessary for the cushion to stop the main piston completely as it does in a duplex pump. After the valve reverses, the small port leading to the counterbore serves as a starting port to move the piston to the point where the main port is uncovered.

Q 16—*Why are plug piston valves frequently used in simplex steam-pump valve gears?*

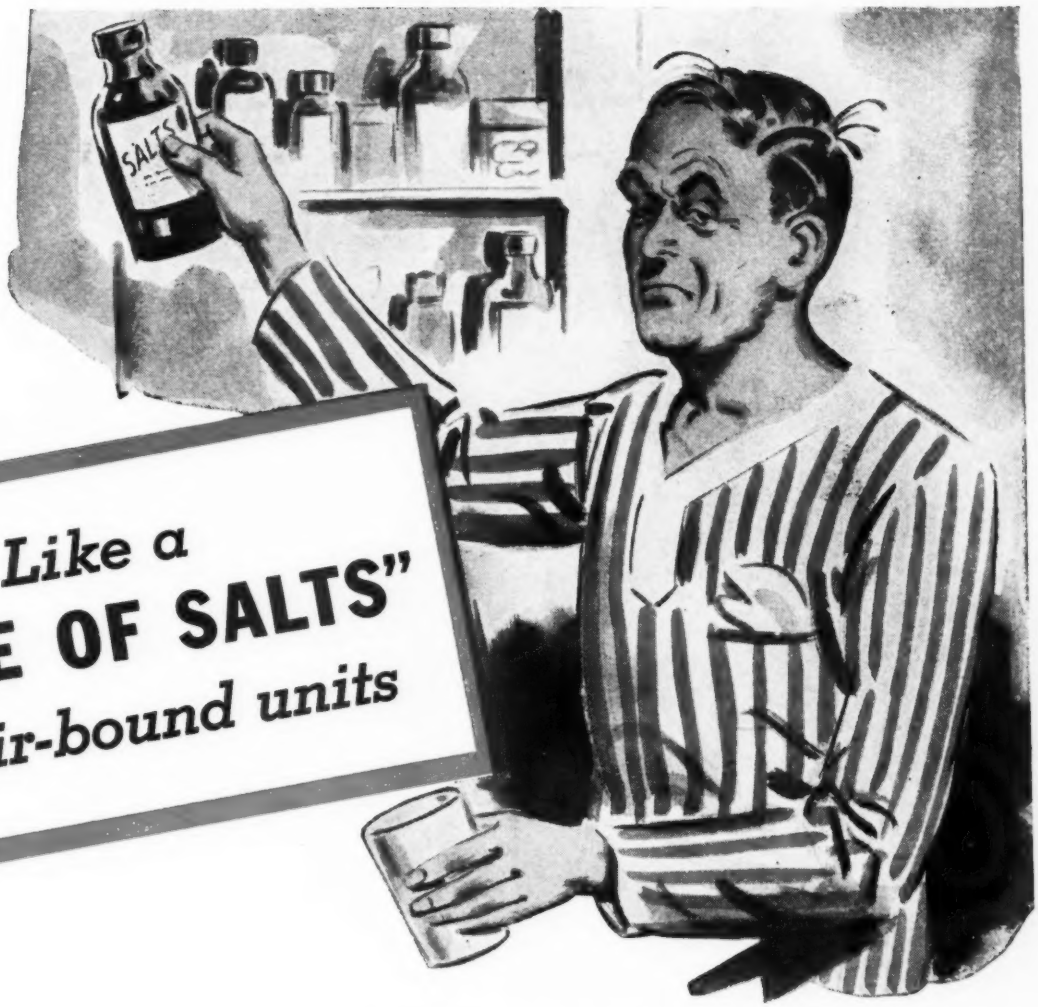
A—In a simplex pump the steam-actuated piston valve travels quickly from one end of the steam chest to the other even at minimum pump speed. Under this condition wire-drawing of the cutoff edges of valve and steam chest cannot be serious. Therefore a simple plug valve in a steam chest without a liner gives good results, and possibly is subject to less wear than a valve equipped with piston rings.

Q 17—*Why cannot a simplex-pump steam valve connect directly to the main piston rod as on a duplex pump?*

A—If this were done the pump would stall instead of reversing, particularly at low speed, because as soon as the steam valve reaches midposition it cuts off both steam and exhaust ports. To avoid stalling requires some means independent of main-piston motion to throw the valve all the way when the control is actuated at each stroke's end. In the earliest designs of direct acting steam pumps the steam valve was actuated by a spring deflected during the stroke against a latch released at the end of the stroke. For many years practically all simplex pumps have had steam-thrown valves which have had an almost infinite number of different arrangements.

Q 18 —*Why are counterbores, Fig.* 1. *provided at each end of a steam cylinder?*

A—They permit the steam piston rings to override the cylinder-bore ends to prevent wearing a shoulder at the end of the stroke. Adjust simplex pumps for full rated stroke so the



Like a "DOSE OF SALTS" for air-bound units

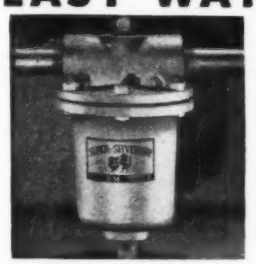
● One manufacturer, tired of the cost of a long heating-up period on pipe coils, changed over to Super-Silvertop Steam Traps equipped with Thermal Air Eliminators. He tells us they act like a "dose of salts" in getting the air out fast.

The purpose of Thermal Air Eliminator equipped Super-Silvertops is quick removal of large volumes of air from steam systems so that steam can get in and go to work. The Eliminator consists of a Spencer Disc mounted on the inverted bucket. When the system is cold, this disc is in the open position and air entering the bucket passes through large ports and out the discharge pipe to the return line. However, when steam reaches the trap the disc snaps shut, closing the ports. Then the trap operates normally, the vent hole in the top of the bucket being sufficient for handling ordinary amounts of air.

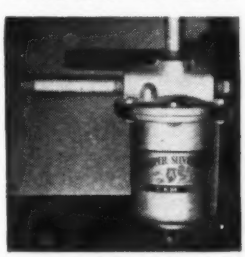
If you have an air-bound condition, Super-Silvertops and snap action Air Eliminators can help you. For further information, send for your free copy of the book, "How To Choose A Steam Trap".

THE V. D. ANDERSON COMPANY
1934 West 96th Street • • Cleveland 2, Ohio

Do it the EASY WAY



STRAIGHT- IN-LINE



AS AN ELBOW

SUPER-SILVERTOP STEAM TRAP

TOP EFFICIENCY *for* CONSERVING HEAT—SAVING MONEY

Effective up to 1800° F.—this easy-to-apply, insulating cement does not break down under service conditions . . .

Here are some figures to indicate how B-H No. 1 Insulating Cement cuts down heat losses, when used on valves:

ASSUMPTIONS: 70° F.—temperature of surrounding still air; 350° F.—hot surface temperature (120 lb. steam); coal at 13000 BTU per lb., utilized at 60% efficiency.

Valve Size	*Insulation Thickness*	*Yearly Saving Per Valve*
3" Globe (screwed)	1"	335 lb.
3" Gate (screwed)	1"	313 lb.
6" Globe (screwed)	1"	831 lb.
6" Gate (screwed)	1"	559 lb.

On flanged valves the saving would be approximately five times as much.

Similar savings are effected when this cement is used on piping, flanged couplings, drum or tank ends, and all irregular surfaces not suited to molded insulations.

Two facts account for the *extra years* of efficient service you get from this product. First, its base is nodulated B-H *black* Rockwool—which keeps its physical properties; the dead air cells mean both maximum insulating efficiency and light weight. Second, a special rust-inhibitor safeguards the metal against corrosion, insures a lasting, firm bond.

B-H No. 1 Cement is easy to use, easy to store—efficient up to 1800° F., reclaimable up to 1200°—ideal for maintenance work.

Use the coupon below to secure a practical sample and an illustrated folder of performance charts and data—together with general application recommendations.

Baldwin-Hill

SPECIALISTS IN THERMAL INSULATION PRODUCTS

Baldwin-Hill Co., 609 Breunig Ave., Trenton 2, N. J.

Send information on products checked below:

- ☐ Free sample of B-H No. 1 Cement
- ☐ No. 100 Pipe Covering—effective up to 1200°F. (for long runs overhead, underground, Diesel exhausts)
- ☐ Mono-Block—the one-block insulation for all temperatures up to 1700°F.
- ☐ Black Rockwool Blankets (felted between various types of metal fabrics)

NAME _____ POSITION _____

FIRM _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

piston rings run past the end of the cylinder bore. In a duplex pump it is impossible to prevent short-stroking at reduced speed, but it may be reduced to a minimum by adjusting steam cushion and lost motion.

Q 19—What is normal or rated stroke of a direct-acting pump?

A—Normal or rated stroke is that length indicated on the pump's nameplate. A pump should maintain approximately this stroke over a considerable range of speed without the piston contacting the steam cylinder heads at maximum operating speed. At normal stroke the leading steam-piston ring should slightly override the counterbore's edge at each end of the cylinder, thus preventing shoulders forming with wear.

Q 20—What is contact stroke of a direct-acting pump?

A—It is the maximum stroke. During such operation the steam piston touches or strikes the cylinder head at each stroke's end.

Q 21—How many steam-piston rings are used on a direct-acting pump?

A—Since these rings must be relatively wide to meet all operating requirements, usually only two are used.

Q 22—Why do steam pistons of many direct-acting pumps have a groove G between the two piston rings, Fig. 7?

A—With a plain piston in large-sized pumps a dull knock frequently occurs at each end of the stroke, even though the piston stops some distance from the cylinder head. This knock is particularly noticeable when the piston is at the top cylinder end of a vertical simplex pump. Many operators have attributed this knock to the quick rise in pressure in the steam port following reversal of the valve, in the belief that the piston was driven against the side of the cylinder opposite the steam port.

The same kind of knock occurs in large horizontal duplex pumps in which the steam port leads into the cylinder counterbore and the exhaust ports in the cylinder bore are the only ones covered by the piston body. Under these conditions the knock can be caused only by suddenly releasing steam pressure from between the two rings on the piston's side covering the exhaust port. A groove between the piston rings equalizes the pressure around the piston sufficiently to prevent this annoying but not serious condition.

Q 23—Why is a groove, G, provided in the valve seat at each end of steam-slide-travel, as in Fig 4?

A—If a flat valve is not permitted to

"Saved $2,000 in the first 4 months!" reports one mine operator after he had installed G-E pole-type Pyranol capacitors at a cost of $5,000.

LET G-E PYRANOL CAPACITORS Boost Your Electrification Gains

Assure Top Performance, Reduced Power Costs, Through High Power Factor

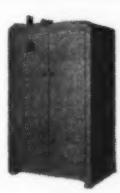
The economies obtained by increased electrification of industry can be seriously affected by a low power factor and the resulting high power costs. This needn't happen in your case—if you take advantage of the savings made possible by proper capacitor utilization. If you buy power and your contract contains a power-factor adjustment or kva-demand clause, capacitors can reduce your power costs by giving you more "working" power for every dollar you spend.

If you operate your own power plant, capacitors enable your generators to deliver more "payload" kilowatts—up to their maximum rating. In either case, they improve your voltage, reduce power losses, and help prevent system overloading. Very often, too, a capacitor installation permits the addition of more motors or other electrical equipment to a "fully loaded" system without the expense of additional feeders, transformers, or generators.

Users tell us that G-E capacitors return from 57 per cent to 120 per cent of their original cost every year. In other words, they pay for themselves many times over. Reliability of operation, of course, is essential before you can realize any worthwhile savings and G-E Pyranol capacitors are noted for the care and precision used in their manufacture. They're non-inflammable, hence less expensive to install. They are smaller than other types, require less space, and they have stable operating characteristics that assure long life.

Applying capacitors to secure maximum savings requires a study of your existing and anticipated circuits and power demands. General Electric engineers, because of their wide experience in this field, are able to render this service. Why not consult with the G-E office nearest you? *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*

ENCLOSED CAPACITOR UNITS for single motors or small loads. Ratings from 0.5 to 7.5 kvar, 230 volts; 1 to 15 kvar, 460 and 575 volts for 1-, 2-, or 3-phase.



SMALL INDOOR EQUIPMENTS occupy little space. Available in 1-, 2-, or 3-phase ratings up to 90 kvar at 230 volts; 180 kvar at 460, 575, 2400, 4160, 4800 and 7200 volts.

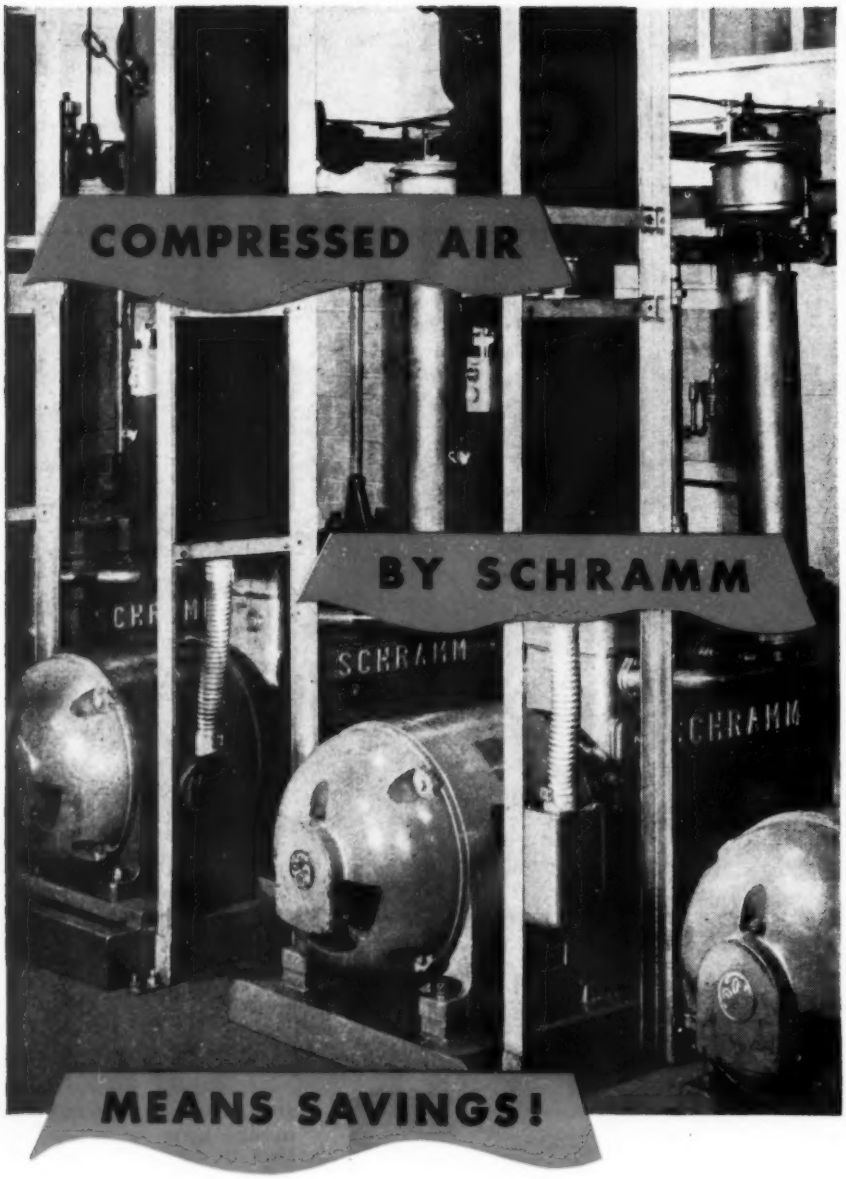
LARGE INDOOR EQUIPMENTS—Large capacity in a single block. Ratings up to 630 kvar, 230 volts; 1260 kvar, 460 and 575 volts; and 2520 kvar, 2400 to 13,800 volts. With or without breakers.

POLE-TYPE OUTDOOR EQUIPMENTS—Completely weatherproof, all-welded steel housing. Pole or base mounting. For primary circuits, 2400, 4160, 4800, and 7200 volts. Ratings up to 180 kvar, 1-, 2-, or 3-phase.

LARGE OUTDOOR EQUIPMENTS—Large capacity in a single block. Weatherproof. With or without circuit breakers. Available in same voltage, kvar, and phase ratings as large indoor equipments.

GENERAL ELECTRIC

407-107-5700



SAVINGS because you get all the
air you want—easily and economically
—with Schramm Air Compressors!

Schramm Air Compressors are compact, sturdy,
vibrationless . . . and offer such distinctive features
as 100% watercooled . . . mechanical intake valve . . .
forced feed lubrication . . . and easy starting.

Schramm offers you many savings, as industries
using Schramm have discovered. We invite
you to write us today for full descriptive catalog.
From it you will see the wide range of sizes
and models offered by Schramm, and what
unit best fits your needs.

SCHRAMM INC.
THE COMPRESSOR PEOPLE
WEST CHESTER
PENNSYLVANIA

152 (641c)

overtravel the length of the seating surface, wear forms a shoulder. This rounds the valve's cutoff edge and tends to lift it off its seat at the end of each stroke, causing steam leakage and cutting of the seating surfaces. If a raised valve-seat face is not provided, cut or cast a groove with its inner edge inside the end of minimum valve travel.

Q 24—What materials are used in the steam end of a direct-acting pump?

A—For most services cast iron is an excellent material for cylinders, cylinder heads, steam chests, valves and steam pistons and rings. It is readily cast in the complicated shapes required and, largely because of its free graphite content, possesses good wearing qualities, particularly where lubrication is not permissible. Steel piston and valve rods are usually used with bronze-bushed stuffing boxes and glands. Piston rods are frequently made of monel.

For higher pressures and superheated steam and for naval combat and auxiliary vessels, cast-steel cylinders with iron linings are used. In marine service steam-cylinder lubrication is seldom permissible and a combination 2-piece piston ring of iron and bronze is used to obtain a reasonable service life under the most severe conditions.

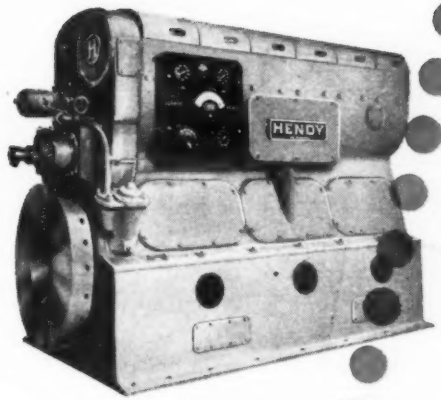
Swiss Expansion

(*Continued from page* 87)

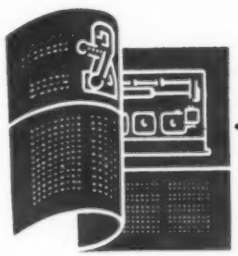
Rhine, Reuss and Linth Rivers are considered most suitable, but the displacement of native populations and the flooding of historic valleys have brought strong objections that have not yet been overcome.

The most grandiose of these schemes calls for construction of a dam, approximately 675 ft high, across the Reuss just below the famous tourist center of Andermatt. Planned to take 19 years to complete, at a cost of $275,000,000. the project would serve five power plants with a maximum capacity of 1,200,000 kw and an output of 2.8 billion kwhr annually. It would add 35% to Swiss hydro capacity, exclusive of production by railroads and industries for their own use.

Rheinwald Project. The Rheinwald project calls for a dam 515 ft high, storing 280,000,000 cubic meters of water. At the dam will be the 48,000-hp Sufers plant. Water from another storage basin below the dam, fed also from another valley, would go through falls at Andeer (250,000 hp) and Sils-



take a look at the latest . . . for three cents



See what a really modern Diesel looks like . . . discover what it can mean to you in economy and dependability . . . study the specifications of the new Hendy Diesel . . . the last word in power . . streamlined, up-to-the-minute design in every detail.

Write today for literature describing the new Hendy Diesels and Diesel-electric sets . . . 190 to 780 hp . . . with generators from 100 to 500 kw . . . You can afford to compare . . . you can't afford not to.

Power by Hendy

Joshua Hendy Iron Works • Est. 1856

Plants: Sunnyvale and Torrance, California.
Crocker-Wheeler Electric Division: Ampere, New Jersey.
Branch Offices: Boston, Buffalo, Chicago, Cincinnati, Detroit, Los Angeles, New York, Philadelphia, Pittsburgh, San Francisco, Washington.

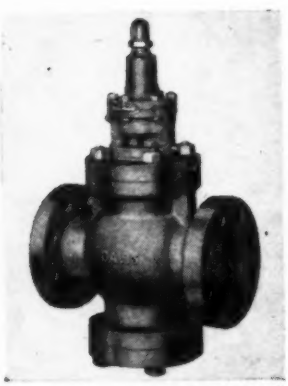
PRESSURE REGULATORS

for every purpose

- 18 Different Types
- For Reduced Pressures up to 500 p.s.i.
- Sizes to 24"
- For Oil, Water, Gas, Steam
- Either Spring or Weight Loaded

Right: Davis No. 14 direct connected spring loaded regulator for steam, air, gas, water, oil. For pressures to 400 p.s.i. For reduced pressures 0 to 200 lbs.

Below: Davis No. 40 regulator for heavy duty, variable load conditions. Unaffected by high pressure fluctuations. Self-contained, pilot operated. For pressures to 400 p.s.i.



Davis No. 401 regulator. A compact instrument type for accurate, sensitive pressure control. Sizes ½" to 10".

The complete Davis line includes a pressure regulator that will fit your requirements, whatever they are.

Davis *double seated balanced disc* regulators for continuous flow conditions.

Piston type, counterweighted, for pressures of 150 lbs. and less.

The *diaphragm type* for low service pressures.

For dead end service, a *single seated type* maintains pressure reduction irrespective of flow.

Davis *integral auxiliary pilot* controlled regulators for heavy duty, variable load service for either dead or continuous flow.

Davis separate auxiliary control type has positive control of disc action, and gives dependable, accurate regulation under variable conditions.

Bulletin 100A and easy-to-use selection charts make pressure regulator selection easy. Send for literature today.

DAVIS REGULATOR CO.

2540 Washtenaw Ave. Chicago 8, Ill.

DAVIS VALVES

DAVIS REGULATOR COMPANY

(128,000 hp) giving the entire project 426,000 hp (328,000-kw generator rating). Output is calculated at 1.1 billion kwhr annually, with 61.5% available for winter use.

On the Upper Linth River, in the canton of Glaurus, and on the Blenio in Tessin, studies indicate several projects for about 200,000 to 250,000 kw total could yield some 900,000,000 kwhr annually, about 50% in winter. A 2-level 96,000-kw project in Bergell could produce about 290,000,000 annual kwhr. In the lower Engadine plans are under way for a 4-level project of 214,000 kw, to supply 408,000,000 kwhr in winter and 527,000,000 in summer.

Marion Plant

(*Continued from page* 70)

periodic tests indicate no such need.

Certain difficulties have appeared from time to time; some were completely corrected while others are still under study. Some of these were common to most contemporary designs, others are peculiar to this installation.

The earliest fault was found and corrected before start-up. Upon failure of wedging in certain of their generator fields, General Electric Co examined this unit's rotors and removed them to the factory for rebuilding before initial operation. The most serious and expensive failure occurred shortly after the low-pressure element was placed in service. Local overheating in the generator armature broke down stator-coil insulation to the point where the machine tripped out while carrying full load. Repair necessitated completely restacking the armature iron and the machine was out of service for more than six months.

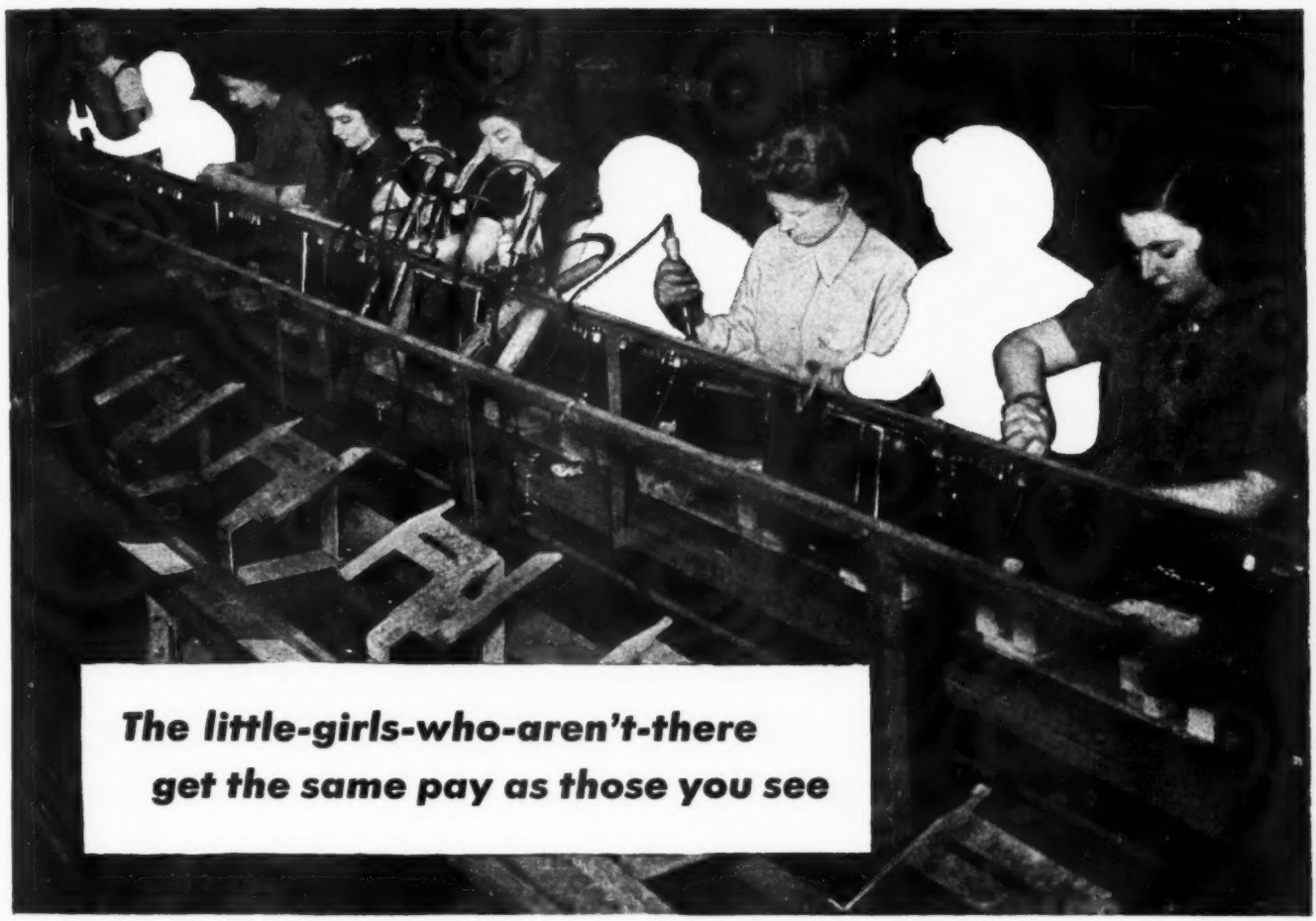
Only other difficulty with the turbine-generators was with the drive to the main oil pumps of the low-pressure element. Several changes have been made to the bearings of the 12-ft-long drive shaft to prevent breakage due to misalignment.

Boiler operation has been successful, although furnace-wall corrosion known as tube wastage is noticeable. So far no tube replacements have been needed. Closely spaced flat studs have been welded to the faces of the most vulnerable tubes, thus transferring metal wastage to the more easily replaced studs.

Failure of the city-water cooling coil, which forms the slag-top hole in the primary-furnace floor, has caused the

Wire ahead...

for productive payrolls



TODAY'S WORKERS need today's wiring. . . . Inadequate wiring, obsolete wiring, overtaxed wiring, over-extended wiring can cut operators' efficiency from 25 to 50 percent and reduce production accordingly.

To visualize the importance of adequate wiring, walk down your own production lines, mentally blank out every third worker. Then, check with your plant power engineer, your consulting engineer, electrical contractor or power salesman and make sure there's no such handicap in your plant.

A wiring survey now, may save costly shut-downs and expensive alterations later.

DON'T BE PENNY-WISE AND POWER-FOOLISH

ANACONDA **ANACONDA WIRE & CABLE COMPANY**

Deliberate on DARTS

You'll Find that Two Bronze Seats Ground to a True Ball Joint Mean Longer, More Economical Service

This exclusive feature of the Dart Union means it will close easily to a leakproof connection — open just as easily whenever it is needed elsewhere. High-test, air-refined malleable iron body and nut are practically indestructible.

Ask your supplier to demonstrate Darts.

E. M. DART CO. DART UNIONS PROVIDENCE, R. I.

only boiler forced outages. Originally thought to be caused by scale forming on the coil water side, these failures have not been solved conclusively.

Principal difficulty with coal-pulverizing system operation has been excessive wear of the main gears driving the mills. Apparently insufficient lubrication caused this since a force-feed lubricating system installed subsequently has brought considerable improvement.

The main condenser has performed creditably in all respects but one: Deaeration of heater drains and makeup water is below guarantee. Minor changes can probably remedy this defect. Necessary material has been available over two years but the unit has not been out of service long enough to make these alterations. This also applies to changes General Electric Co would like to make to automatic valves in the two 24-in. steam lines that interconnect the high- and low-pressure elements.

A problem common to many high-pressure boiler-feed pumps has appeared in the form of erosion and corrosion of leakoff devices and diffusers. Maintenance on these items occurred so frequently that a complete spare internal assembly for each set of four pumps was purchased before it was found that making the diffusers and balancing devices of stainless steel would permit reasonable operating life. To learn more of the phenomenon, Public Service Electric and Gas Co and other companies are conducting studies.

Drainage from the closed heaters has been difficult to control as far as flash is concerned: Several instances of pipe and valve erosion have occurred to the point of failure. Short of redesigning the piping system, the only remedy applied has been to replace (1) damaged pipe with one of heavier wall thickness and (2) V-ported valves with parabolic disks.

Experiments with flyash disposal at Marion have produced a reasonably successful method: Precipitated flyash is injected into the quieter sections of the primary furnace and then melted down and carried out as slag. Some additional work is still required to perfect this system.

Station operating heat rates have varied from 10,500 to 11,000 Btu per kwhr. Equipment availability has been excellent and varied as follows:

	Availability, %	
Year	*No. 10 H-p*	*No. 10 L-p*
1942	87.57	——
1943	98.88	67.13
1944	97.56	98.71
1945	99.45	99.45

FLAMENOL

STYLE FL

INSULATED
WIRE and CABLE

GENERAL ELECTRIC

FLAMENOL FOR TOUGH WIRING JOBS

GIVES THESE 12 BIG BENEFITS

1. **FLAME RESISTANT**—does not support combustion.

2. **CORROSION RESISTANT**—immune to action of oils, acids, alkalies normally encountered in service.

3. **AGELESS**—does not oxidize. Highly resistant to sunlight and weather.

4. **EXCELLENT PHYSICAL PROPERTIES**—has minimum tensile strength of 1500 pounds per square inch; minimum elongation of 100 per cent.

5. **SUPERIOR DIELECTRIC STRENGTH**—Tests on No. 14 wire with 2/64-in. insulation show a breakdown strength of 720 volts per mil.

6. **SMALL DIAMETER**—saves space; makes wiring easier.

7. **SMOOTH, TOUGH SURFACE**—makes pulling through conduit easier and quicker.

8. **STRIPS CLEAN**—speeds soldering, splicing, terminating.

9. **DIFFERENT COLORS**—simplify hook-up and circuit tracing.

10. **VARIOUS TYPES**—aid selection for special applications.

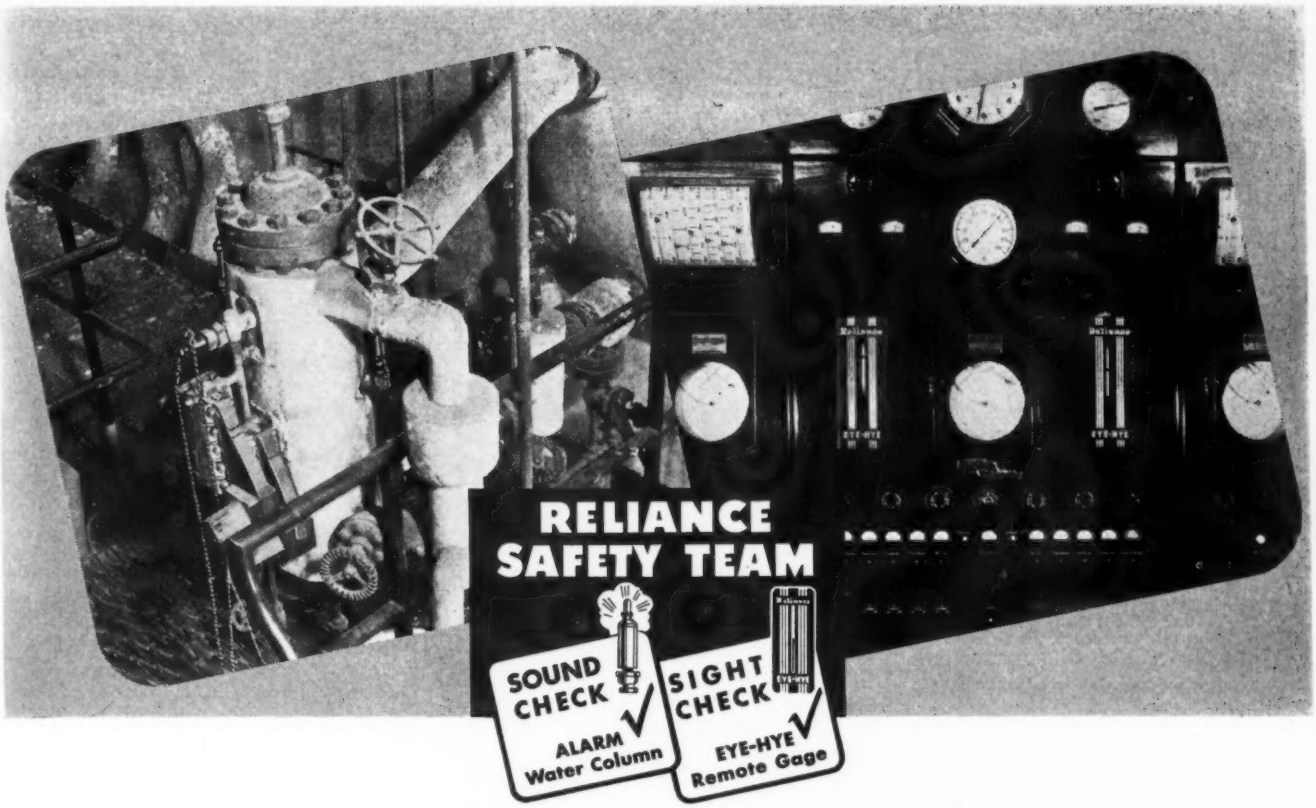
11. **SELF-PROTECTING FINISH**—normally eliminates need for armor braid, requires less space.

12. **ATTRACTIVE APPEARANCE**—looks new, stays new over long periods of time; never needs painting but can be painted without harm.

For more information on Flamenol Style FL wire and cable, ask the nearest G-E office for a copy of GEA-4352, or write General Electric Company, Schenectady 5, N. Y.

502-61-1200

APPARATUS DEPARTMENT, GENERAL ELECTRIC COMPANY, SCHENECTADY, N.



How the Reliance Safety Team gives you *Double Supervision* of your important Boiler Water Levels

● Prevent boiler outage and expensive water level accidents by having *adequate* boiler water supervision — so easy to obtain with the Reliance Safety Team — ALARM Water Column and EYE-HYE Remote Reading Water Level Indicator. Save your operators hours of time, thousands of steps in their vital job of checking the "life blood of the boilers."

Reliance ALARM Water Column

The ALARM is your reliable SOUND check. Standing guard at boiler drum, its sensitive mechanism responds instantly to dangerously low or high water levels — warns boiler-room men by shrill whistle or electric signal. Its few working parts, its rugged construction — much heavier than required per pressure rating — assure trouble-free operation and a life as long as the boiler's. Reliance ALARMS are made for all types of boilers, all working steam pressures up to 900 pounds. Reliance High Pressure Water Columns are available for pressures to 2000 pounds without Alarms.

EYE-HYE Remote Reading Gage

The modern SIGHT check for water levels is the EYE-HYE. While the gage at the water column cannot be dispensed with, EYE-HYE is a convenient auxiliary that brings the reading down to an eye-level position, on wall or instrument panel. Is accepted in some codes as the *second* gage where two gages are required on higher pressures. Positive hydrostatic operation — as simple as the usual water gage. Has no moving parts. Shows exact reading in a brilliant illuminated green column — can be seen many feet away. Practically no upkeep expense. Models for any pressure, up to 2000 pounds.

BOILER SAFETY DEVICES since 1884

Reliance

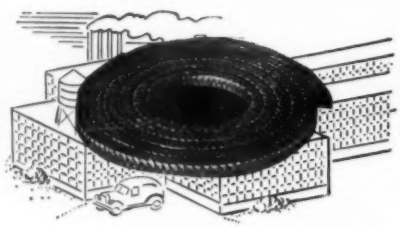
THE RELIANCE GAUGE COLUMN CO. • 5902 CARNEGIE AVENUE • CLEVELAND 3, OHIO

WOULD ONE OF THESE *Packings* END ONE OF YOUR PACKING PROBLEMS?

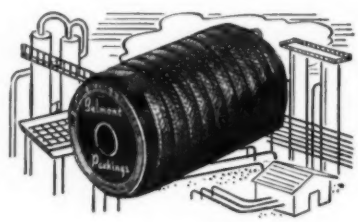
As examples of the extra service you get from Belmont Packings, here are three packings built with special features to give you better sealing and longer life. And for *any* steam, water, oil, gas, air, acid, alkali or ammonia service . . . tell your distributor: "Belmont".

Extra sensitive to gland pressure. Belmont 2 Diagonal Wedge Expansion Packing has sliding rubber and duck diagonal wedges incased on three sides with rubber and duck channel. For reciprocating rods and plungers (especially when worn) working against hot and cold water, steam up to 340°F., ammonia.

For rotating shafts. Every strand of asbestos yarn in Belmont 754-P Centrifugal and Rotary Pump Packing is thoroughly lubricated and graphited, resulting in a packing that will keep pliable for long, economical service.



For gasoline and other petroleum distillates. Belmont 6100 is made of a high-grade asbestos yarn, firmly braided, each strand thoroughly impregnated with a special compound to retain softness and essential sealing qualities when applied against volatile distillates.



There is a Belmont Packing for Every Service

Belmont distributors are located in every large industrial center, ready to give you prompt delivery from local stocks.

THE BELMONT PACKING & RUBBER CO. — BELMONT — PHILADELPHIA, U.S.A.

IN THE BLUE-AND-ORANGE BOX

6 New Folders
Write us for new folders on Belmont Centrifugal and Rotary Pump Packings, Flax Packings, Hollow Center Packings, Oil and Gasoline Packings, Rod Packings, Sheet Packings.

THE BELMONT PACKING AND RUBBER CO.

Butler and Sepviva Streets

Philadelphia 37, Pa.

Engineer's Bookshelf

(*Continued from page* 144)

devices and controls. The closing chapter is devoted to the very worth-while NEMA listing of properties and characteristics of industrial control apparatus.

SWITCHBOARD AND PANELBOARDS (1945) *By E S Lincoln, consulting engineer.* 150 *pp*, 8½x5½, *illust, cloth.* $3. *Duell, Sloan & Pearce, Inc,* 270 *Madison Ave, New York* 16, *N. Y.*

Switchboards, switchgear and panelboards come in for step-by-step treatment. The author discusses each major class of equipment ranging from types within a class through ratings, definitions and applications. A device frequently used in his series again proves a desirable feature: liberal and frequent use of the appropriate sections of the National Electrical Code as well as suggestions and instructions issued by National Electrical Manufacturers Ass'n for installation and operation of the equipment under discussion.

ELECTRONS IN ACTION (1946) *By James Stokley,* 320 *pp,* 5½x8, 89 *illust, cloth,* $3. *McGraw-Hill Book Co,* 330 *W* 42*nd St, New York* 18, *N.Y.*

Before an airplane pilot, as he flies above a thick cloud, there appears an accurate picture of the terrain below. A foundry technician sees a flaw inside a thick steel casting. A piece of metal placed inside a wire coil becomes red hot almost instantaneously. While seated comfortably at home, a man sees a football game many miles away. At the heart of these and many other seeming miracles are *Electrons in Action,* the appropriate title of this book.

Of the many good books in popular style on the atom's structure, this one is probably the best and most practical. Beginning with an account of what electrons are, and where they come from, the author explains the elements and characteristics of electron tubes and their applications. Other chapters deal with electronics in industry, sound recording, computing, X-rays, betatrons, measurements, and with the electron microscope. Outstanding are the chapters on radar, loran, the atomic bomb, and atomic energy.

Explained is the electron arrangement in an atom that makes helium, neon, argon and certain other gases inert. It is shown how electrons' mass increases when they are accelerated almost to the speed of light. Clearly written in non-technical language this book is packed with tantalizing, but thoroughly practical and realistic theory of what electronics are doing and what they may do for all of us tomorrow.

ELECTRONICS IN INDUSTRY (1946) *By George M Chute, application engineer, General Electric Co,* 461 *pp,* 5½x8, *illust, cloth.* $5. *McGraw-Hill Book Co,* 330 *W* 42*nd St, New York* 18, *N. Y.*

Written chiefly for men with little technical training this book describes and ex-

THESE BOYS ARE "Dead Pigeons" IN THIS PLANT

1. Maximum Capacity when needed most
2. Accurate Pressure Control under toughest working conditions
3. Trouble-free Service
4. Smooth Operation
5. Tight Closure
6. Accurate Regulation
7. Speedier Production Results
8. Elimination of Failures
9. Constant Delivery Pressure
10. Cost Saving Operation
11. No Spoilage
12. Practically zero in maintenance costs

Here's the Reason

CASH STANDARD *Streamlined* TYPE 1000 PRESSURE REDUCING VALVE

Installation of this CASH STANDARD "1000" is a blow that knocks these trouble makers and cost raisers stiff and cold . . . permanently. When the CASH STANDARD "1000" goes to work you immediately get good streamlined valve performance with good cost savings . . . for years.

Send for a copy of Bulletin 962

You can read about the "straight line flow" and other features of the "1000" that make valve troubles disappear from your plant in our Bulletin 962. You'll see why it is easily possible for you to enjoy all 12 points listed on this page through the simple installation of the CASH STANDARD Streamlined Pressure Reducing Valve.

CASH STANDARD CONTROLS.. VALVES

A. W. CASH COMPANY
DECATUR, ILLINOIS

BULLETINS AVAILABLE ON OTHER CASH STANDARD VALVES

Send for them

BULLETIN 965—
features the CASH STANDARD "42" Series—a complete line of balanced lever valves for handling almost anything that will flow through a pipe except some injurious chemicals. Two full pages show 16 installations with descriptions.

BULLETIN 963—
features the CASH STANDARD Type 100 Series of Super-Sensitive Controllers — various types for automatically operating valves, dampers, rheostats, stokers, pulverizers, fans, and other apparatus. 16 pages filled with descriptions and applications.

BULLETIN 956—
features the CASH STANDARD Type 4030 Back Pressure Valve—designed to automatically maintain a constant pressure in the evaporator corresponding to a constant temperature desired. Shows an Ammonia and Freon Gas Capacity Chart based on ABSOLUTE pressures.

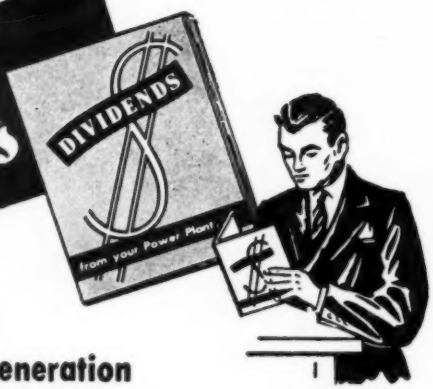
BULLETIN 967—
features the CASH STANDARD Type 11 Condenser Water Regulator — self-contained — pilot-operated, for controlling the flow of cooling water to condenser coils. Used with water or air—with any gas or oil that is non-corrosive — and with all refrigerating fluids. Capacity charts are shown.

BULLETIN 968—
features the CASH STANDARD Type 34 Pressure Reducing Valve — direct-operated — direct acting for handling steam, hot water, cold water, air, oil, brine—and most liquids and gases except some injurious chemicals. Illustrates and describes the different styles available and tells about their applications. Three pages of capacity charts.

BULLETIN 969—
features the CASH STANDARD Series 35 Constant Pressure Pump Governors — direct-operated and pilot-operated which automatically control steam-driven pumps to maintain a constant pump discharge pressure (or constant vacuum on vacuum pumps). Tells about their use with reciprocating pumps, turbine-driven pumps and compressors; including compressors for refrigeration use. Has two pages of typical installations.

Power Plant Engineers:

MANAGEMENT IS READING *Your Thoughts*



on the Profit-Value of Modern Steam Generation

We mean that literally. Throughout the country, thousands of executives are reading an authoritative 36 page booklet which speaks for the power plant engineer.

That booklet, published by Preferred Utilities, is "Dividends From Your Power Plant." It translates your technical understanding of the problems of power generation into concise, easily-understood terms so that management can quickly grasp their import. Ten comprehensive articles—each one written by a steam generation specialist—describe the relation between steam costs and production economy. They *prove* that "there's profit in power."

Here are a few typical quotes which may guide management to a better understanding of *your* job:

"Your Engineer is a Gold Mine but you may have to dig for the ore."

"Good Boilers Can Waste Money by scattering heat into the sky."

"Your Engineer is no salesman. It's up to you to cultivate the profitable habit of consulting him regularly."

Send for your FREE copy of "Dividends From Your Power Plant" today! After you've read it . . . route it to the front office. Incidentally, it contains absolutely no advertising . . . but it may prove to be quite a promoter for you!

SIGN AND MAIL TODAY

PR-128

PREFERRED UTILITIES MFG. CORP.
1860 BROADWAY NEW YORK 23, NEW YORK

Please send me FREE and without obligation, bulletin #1000 and the ten articles in booklet form, titled—"Dividends From Your Power Plant".

Name.....

Company Name.....

Street.....

City..... **State**.....

P-9-46

PREFERRED UTILITIES — Rigged for Results — ENGINEERS

plains a wide variety of electronic equipment in industry. No previous knowledge of electronic tubes is assumed. They are introduced gradually in simple operating circuits to acquaint the reader with the purpose of electronic equipment before exploring the characteristics of the tubes themselves.

Many kinds of complete industrial electronic circuits are explained. Circuits are traced in terms of electron flow instead of the conventional current flow. With many examples of increasing complexity it is shown how electronic tubes and tube-operated circuits function in many kinds of industrial electronic applications.

The book is based on an evening study course in industrial electronics taught by the author in Detroit for several years and sponsored by the University of Michigan Extension Service. Students come from many industrial plants, looking for general knowledge of electronics so they can understand and service equipment already installed.

The detailed way in which the explanations are worked out makes the text well suited to home study. The student can check his understanding from review questions at the end of each chapter. Some questions require explanation; others require true-or-false answers, which are given in the back of the book.

STEAM POWER PLANT AUXILIARIES AND ACCESSORIES. (2nd edition 1946). *By Terrell Croft, revision by D J Duffin, editor, Mail Sales Dept, McGraw-Hill Book Co, Inc.* 583 *pp*, 5½x8, *cloth*, $5. *McGraw-Hill Book Co*, 330*W* 42*nd St, New York* 18, *N. Y.*

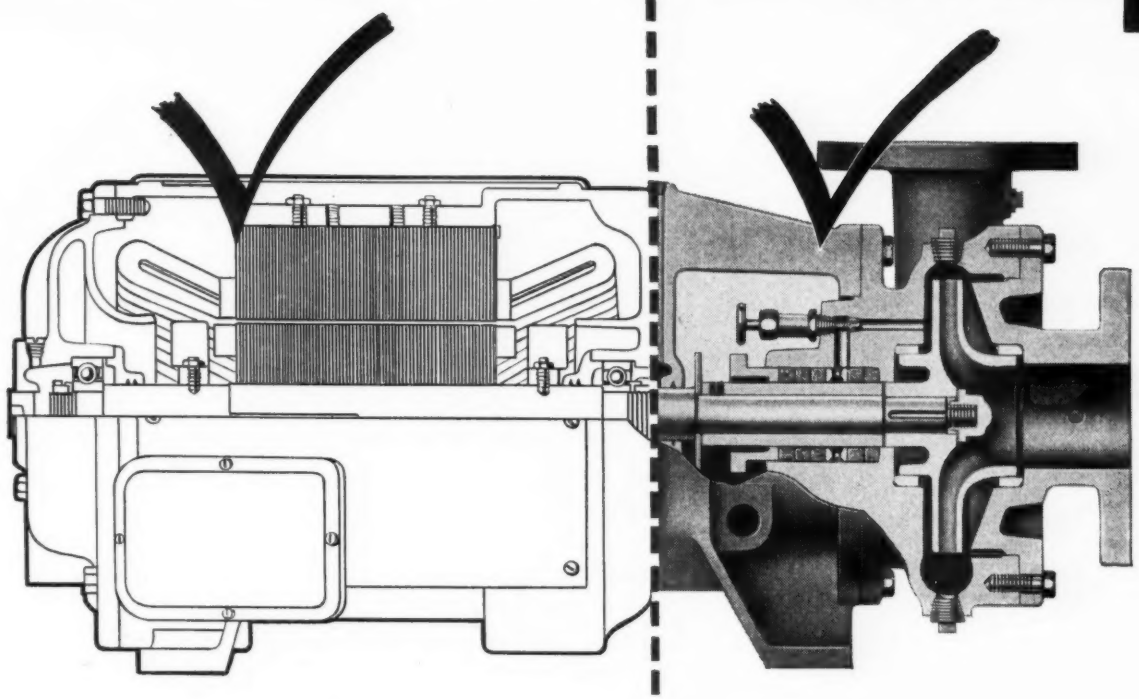
A complete revision of this basic work by Croft, first published in 1922, contains about 250 pages of text and 300 illustrations that are completely new. Evaporators, deaerators, air preheaters, piping maintenance, certain pumps, specific speed, cavitation and motor applications are discussed in this new material. Consideration of high-pressure and-temperature operation and its effect upon plant design constitutes another addition. Recent ASA and ASME recommendations appear in codes for pressure piping and boilers.

Revisions and additions to previous material bring the book up to date with the changes that have occurred over the years. Particular attention to these changes have been made in those sections dealing with pump machinery, boiler-feed apparatus, economizers, feedwater heaters and traps. Original tables and other data presentations have been changed or added to where necessary. The well-received system of questions and problems at chapter endings has been continued.

BUSINESS JOURNALISM: ITS FUNCTION AND FUTURE. *By Julien Elfenbein.* 341 *pp*, 6x8¾, *cloth, illus*, $4. *Harper & Bros*, 49 *E* 33*rd St, New York, N. Y.*

First complete survey of business journalism in 21 years, this manual of trade-paper practice reports on 1600 U. S. and 150 Canadian businesspapers. Not only does it detail the editorial staff's functions and activities but also those of advertising,

Motor *and* Pump



...combined

TO GIVE UNDIVIDED RESPONSIBILITY FOR CAPACITY... EFFICIENCY... HEAD

NOT ONE maker's pump hooked up to another maker's motor —but pump AND motor, designed and built as a unit by Allis-Chalmers.

There's no buck-passing. Allis-Chalmers backs every "Electrifugal" pump all the way — tests and checks the performance of each unit, at the factory.

FOR EVERY PUMPING NEED . . . CALL ON A-C

This versatile, popular "Electrifugal" pump is only part of the complete Allis-Chalmers line of centrifugal, axial and mixed-flow pumps — single or double suction, single or multi-stage, capacities up to 170,000 gpm. Call your A-C office or dealer — or write for bulletin B6018. ALLIS-CHALMERS, MILWAUKEE.

A2073

SPLASH-PROOF, LO-MAINTENANCE MOTOR — specially built for pump service. Sturdy, long-life rotor, interchangeable stator coils.

PUMP AND MOTOR IN ONE RUGGED FRAME, and on the same shaft. Result: perfect alignment; smooth, vibrationless operation; longer bearing life.

EASY INSTALLATION AND MAINTENANCE. Just hook up and pump . . . operates in almost any position . . . all parts easily accessible for checking and service.

SIZES FROM ¾ TO 25 HP meeting a wide range of requirements as to capacity, head, and fluids to be pumped.

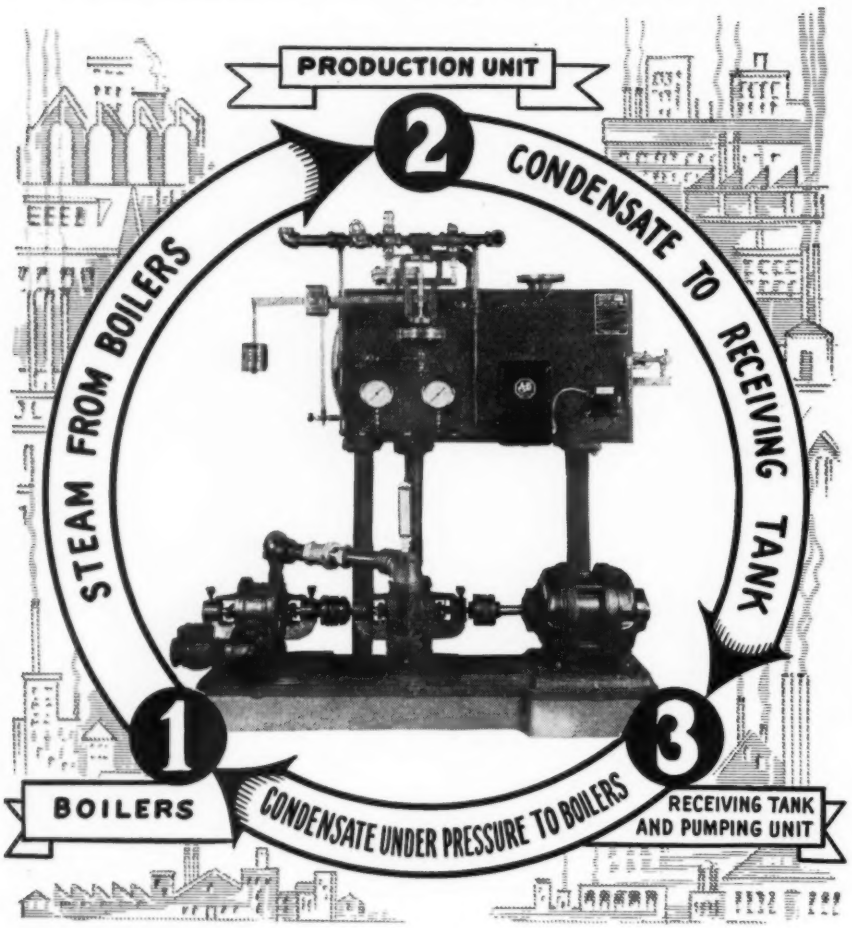
ALLIS-CHALMERS

★ One of the Big 3 in Electric Power Equipment
Biggest of All in Range of Industrial Products ★

Electrifugal PUMPS

INCREASED PRODUCTION —DECREASED COSTS

For Industries Using Process Steam



The Stickle Differential Drainage and Boiler Return System will serve effectively any type of industry using large quantities of steam at medium or high pressures for processing operations. Canning plants, laundries, milk drying plants, sand drying plants, and paper board mills are examples of the type of plants where it has proved itself for reducing costs and increasing efficiency.

This system affords these definite advantages: (1) Returns condensate from processing units to boilers, under pressure, at a temperature only 15 to 20 degrees lower than temperature of steam at operating pressure—saving fuel and increasing boiler capacity. (2) Supplies positive and correct drainage—assuring maximum production of units. (3) Eliminates high velocities and reduces scale—decreasing maintenance costs. Bulletin No. 250 supplies complete data.

OTHER STICKLE EQUIPMENT

Stickle Open Coil Feed Water Heaters—small to large capacities, deaerating and non-deaerating types, cast iron or steel construction. Bulletin No. 117.

Stickle Regulating and Reducing Valves—two series in standard types designed and constructed for industries requiring dependable and accurate control within extremely close limits of variation. Bulletins Nos. 235 and 435.

Stickle Open Float Steam Traps—in four series designs to meet specific operation conditions. Traps for high, medium, and low pressures and for vacuum service. Specify use in request for bulletin.

STICKLE STEAM SPECIALTIES COMPANY

2265 VALLEY AVENUE, INDIANAPOLIS 1, INDIANA

SPECIALIZING FOR MORE THAN 40 YEARS IN REDUCING THE COST OF STEAM

circulation and promotion departments. The author believes that high-level employment in the postwar era will depend on more efficient distribution under guidance of the business press.

Mr Elfenbein has had over 18 years as business journalist in distribution fields, and has lectured at many universities. He is a member of executive committee, national conference of Business Paper Editors; chairman of its postwar committee on distribution.

Booklet Reviews

THE STORY OF 1946 CODE CHANGES (1946) 16 *pp*, 4x9, *paper. Available on request. Anaconda Wire and Cable Co*, 25 *Broadway, New York* 4, *N. Y.*

The National Board of Fire Underwriters will soon publish a new 1946 *National Electrical Code* in which many changes have been made that directly affect electrical materials and devices and permissible methods of their installation. In this booklet these changes as they concern electric wire and cable are analyzed. Attention is called to methods and materials that should have careful study as they affect the kind of insulated conductors that give highest efficiency at lowest cost.

STANDARD CODE FOR ARC AND GAS WELDING IN BUILDING CONSTRUCTION. 68 *pp, paper*, 50¢. *American Welding Society*, 33 *W* 39 *St, New York* 18, *N. Y.*

A 1946 edition of the Code, just published, replaces the 1941 (tentative) edition. The new edition embodies revisions based on experience in the recent applications of welding to structural fabrication and on research investigation. The design section now provides for increased allowable weld unit stresses equal to those allowed for the steel being welded. Other sections on filler metal, workmanship, inspection and qualification of welding operators and procedures have also been revised.

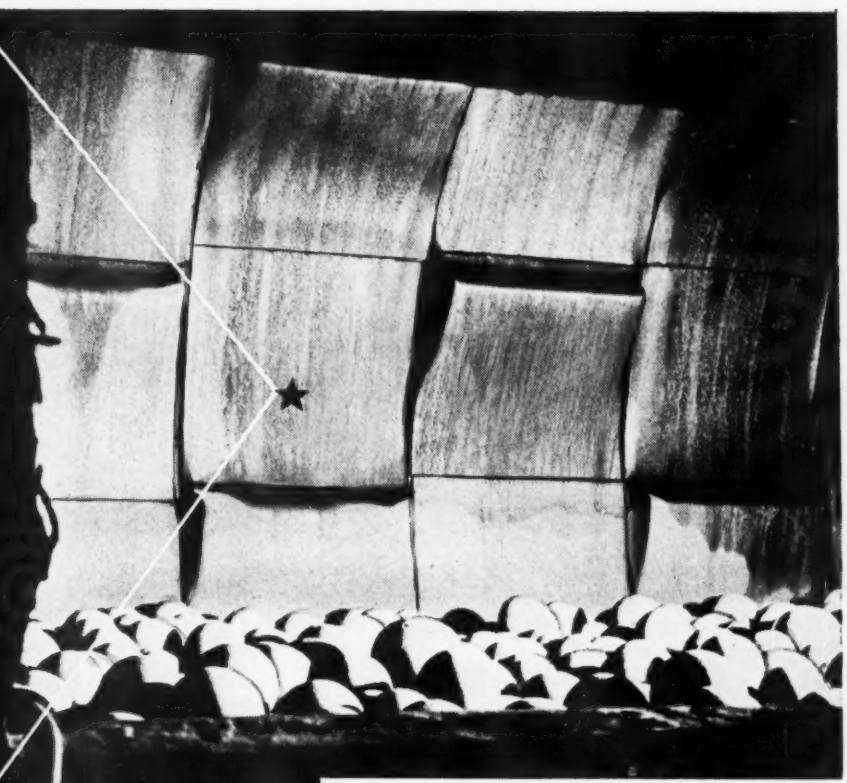
PRESSURE GUAGES *By J R Fawcett, B Sc, A M I Mechanical E*, 26 *pp*, 4¾x7¼, *paper*, 1 *shilling* (*roughly* 25¢). *Emmott & Co, Ltd*, 31 *King St West, Manchester* 3, *England.*

Of special interest to instrument men and mechanics, this booklet contains information of practical value to engineering designers and erectors. It suggests points to consider when buying and installing pressure gages, and outlines the procedure for maintenance and simple repairs.

Electric power for Anchorage, Alaska, will soon be provided by steam turbines in stern half of a wrecked tanker, according to the American Public Works Association. The tanker, *Sackett Harbor*, broke in two during a Pacific storm. Stern half of the ship remained afloat and was towed to Anchorage where the city bought it as war surplus to provide municipal power until permanent facilities can be installed.

These NI-HARD* NICKEL cast iron liners...

Outlasted plain chilled Cast iron 3 to 1



*Ni-Hard—Reg. U. S. Pat. Off. by The International Nickel Company, Inc., Canadian Pat. No. 281,986

Interior view of first compartment in mill for grinding wet stone at Keystone Portland Cement Co. showing alloyed liners. These wave-type liners, cast without bolt holes and keyed in place, measure 17" square by 3" thick. They were supplied in ABK Metal by American Brake Shoe Company, Mahwah, N. J., an experienced producer of this Ni-Hard type alloy.

Searching for ways to combat excessive wear, Keystone Portland Cement Company instituted a long time service test for ABK Metal, a Ni-Hard type alloy mill liner, comparing it with liners of plain chilled cast iron.

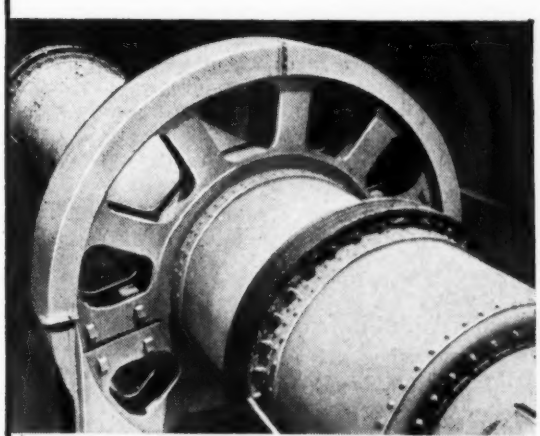
In a mill grinding raw wet stone . . . where abrasion is most severe . . . Ni-Hard demonstrated its exceptional merit by grinding the equivalent of 2,030,000 barrels of cement and remaining still in service for much more grinding. In identical service, plain chilled cast iron liners were good for only 751,000 barrels, a 2.7 to 1 performance with more to come.

This outstanding performance of Ni-Hard led Keystone to install these alloyed liners in their other raw grinding mills.

Ni-Hard is an alloy cast iron containing 4.25 to 4.75% Nickel together with 1.50 to 2.00% chromium. Its excellent resistance to wear and abrasion has led to its wide use in many types of crushing and grinding equipment.

The cement, paint, ceramic, power, mining, coal and coke, and many other industries have adopted Ni-Hard as standard for processing and conveying highly abrasive products. Applications include pump casings, roll heads, muller tires, chutes, ash pipe and grizzly discs.

You'll find it pays to specify Ni-Hard. For additional information write to:



Exterior view of Polysius compartment mill, one of eight used at the Keystone Portland Cement Company plant in Bath, Pa.

THE INTERNATIONAL NICKEL COMPANY, INC. 67 Wall Street New York 5, N.Y.

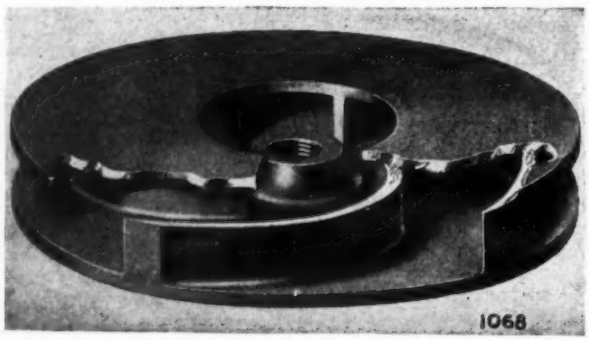
Correct Impeller Is Important In Pumps for Ash Handling . . . .

In an ash handling pump, the impeller is the vital factor upon which performance largely depends.

Amsco-Nagle Type "T" Pumps offer power plants a ball bearing design, suited to the handling of ashes, with wearing parts of "the toughest steel known" — austenitic manganese steel — plus the ideal impeller for pumping ashes.

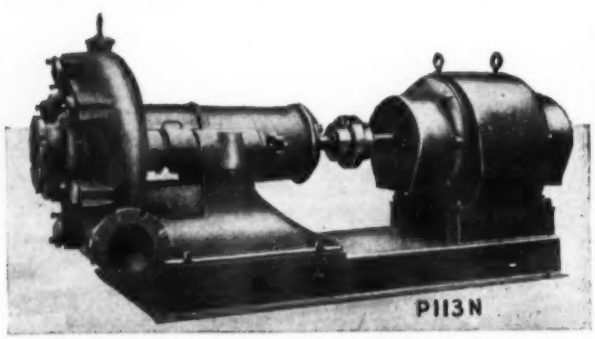
In the important matter of impellers, Amsco engineers have gone far beyond most pump designers to furnish the correct impeller for each application. Amsco-Nagle pumps are made for handling abrasive and destructive materials, common among which is ashes.

Two classes of impeller, either with 2, 3 or 4 vanes, are available for Amsco-Nagle pumps. In these impellers ample attention has been given to the need for proper design of the shroud in the area of the stuffing-box in order to minimize pressure in this important region. To accomplish this it is necessary to avoid communicating the high pressures developed by the pump into this area and to place it into communication with the low pressure conditions on the entrance side. Our means of doing this is by properly designed seals and communicating passages through the shroud. These areas must be of the proper size and shape and in the right direction for satisfactory results. Through proper engineering, stuffing box difficulties and service requirements are minimized.



1068—Class "D" impeller, recommended for ash handling pumps.

For handling coarse abrasive ashes, such as from chain grate stokers, underfeed stokers and some types of pulverized fuel burners, the Class "D", 2, 3, or 4-vane impeller, as shown in the photograph, is recommended.



P-113—8" Type "T", frame 24, Amsco-Nagle Pump, driven by a 75 H.P., 720 R.P.M. motor, for handling ashes in a large power plant.

For handling fine flue dust and for some slag tap furnaces, the Class S impeller is most economical.

Amsco-Nagle Pumps afford maximum economy for ash handling. Made in all sizes from 6" to 16". Write for latest literature.

●

Joliette Steel Limited, Joliette, Quebec, owned by American Brake Shoe Company, produces and sells Amsco Manganese Steel Castings in Canada.

AMSCO

Foundries at
Chicago Heights, Ill.; New Castle, Del.;
Denver, Colo.; Oakland, Calif.;
Los Angeles, Calif.; St. Louis, Mo.
Offices in Principal Cities

AMERICAN MANGANESE STEEL DIVISION
CHICAGO HEIGHTS • ILLINOIS

AMERICAN Brake Shoe COMPANY

New Equipment

(*Continued from page* 136)

capacity to hold minimum head pressure required for proper distribution of refrigerant through its system.

Included also in the water reservoir is an electric heater controlled by a thermostat to operate when temperature approaches freezing in winter. If temperature remains low, sprays and fans are automatically shut off and water feed line drained. A rise in head pressure to a predetermined point again puts condenser into operation automatically.

This equipment makes it possible for condenser to operate with its evaporative cooling capacity completely effective throughout year. **Dept P, Niagara Blower Co, 6 E 45th St, New York 17, New York.**

Compact Coupling

CX DOUBLE-FLEX COUPLING cannot fall off when blower and pump units are serviced. Of one-unit construction, this coupling comes out with shaft when pump or motor is moved. A standard *L-R* body is permanently inserted into the molded synthetic rubber unit, this being permanently secured to pump shaft by a set screw. Molded into the other end are the *L-R* sockets that engage *L-R* jaws on blower hub. Assembly is said to be quick in dark or close quarters. There is no metal-to-metal contact. It has a deeper center hole, allowing shaft to extend ½ in. into unit. Coupling is in six sizes from 2¼ to 5 in. long. **Dept P, Lovejoy Flexible Coupling Co, 5009 W Lake St, Chicago 44, Ill.**

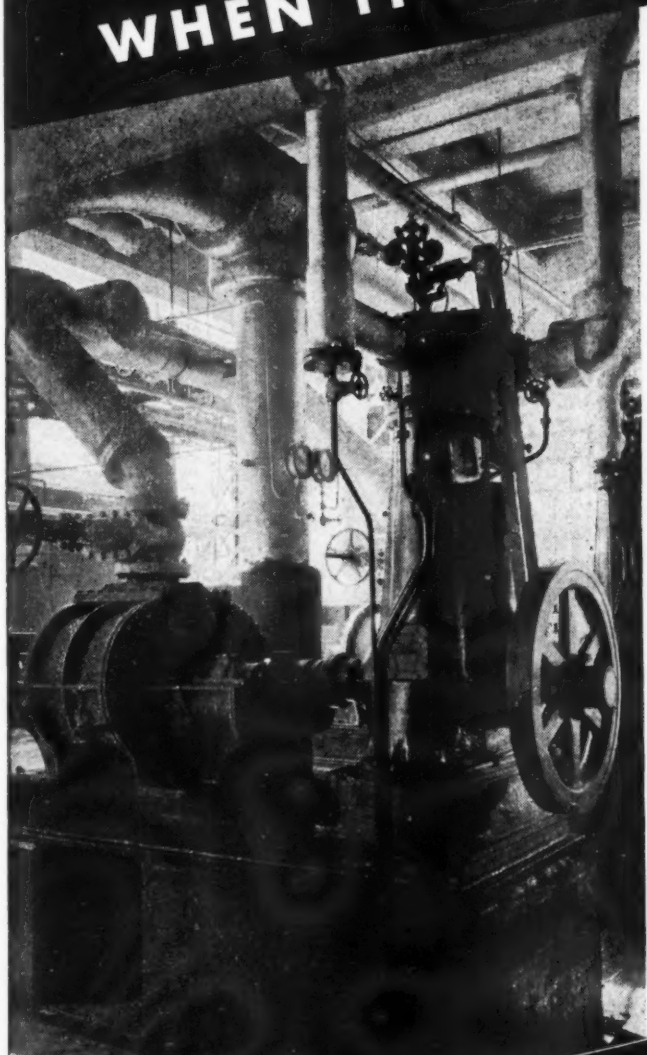
Portable Pyrometer

UNIT PERMITS CHOICE of plug-in angle extensions where a number of applications necessitate a universal instrument for measuring and checking temperatures requiring application of different kinds of thermocouples. High-resistance meter movement consists of baked, processed coils, supported by two lapped pivots resting in two highly polished sapphire resilient jewels. An *Alnico* No. 5 magnet, highly resistant to shock, heat, vibration and stray fields, provides increased ruggedness without a loss of sensitivity. Automatic compensation is a standard feature. A calibrated *Briguet* spiral automatically corrects every reading for variations in cold junction temperature. Shunt lever that can be snapped into position with a simple thumb movement protects meter when instrument is not in use.

Plug-in extensions are available in either

TROY-ENGBERG
STEAM ENGINE

POWER IS MOST MODERN WHEN IT HAS LOWEST COST



The Troy-Engberg Steam Engine is industry's By-Product Power drive and for many plants it could be their most modern equipment . . . producing power at very low cost since the exhaust carries such a high percentage of the heat units needed for heating or processing.

In many plants the Troy Engine is producing power at a cost well under that of any other unit. In fact, it often pays for itself completely within a year or two, driving such commonly-used equipment as stokers, compressors, blowers, pumps, generators, fans, cookers and dryers.

We suggest that you investigate thoroughly the role the Troy Engine could fill in your plant. Steam for heating or processing and need for power are determining factors . . . if you have these requirements, you probably have a place for this modern steam engine.

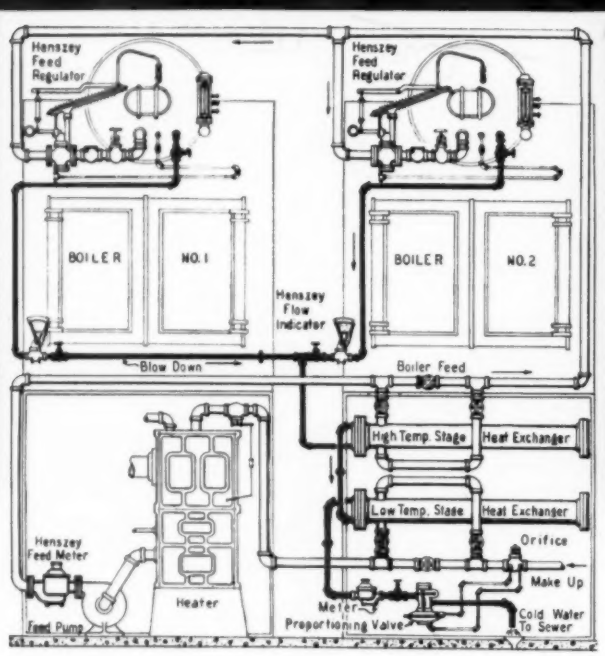
TROY ENGINE & MACHINE CO.
Established 1870
2519 RAILROAD AVE., TROY, PENNSYLVANIA

SEND FOR OUR BULLETIN 306. IT WILL GIVE YOU ESSENTIAL INFORMATION ABOUT THE TROY-ENGBERG STEAM ENGINE.

BULLETIN
306

TROY-ENGBERG
STEAM ENGINES · GENERATING SETS · GENERATORS

HENSZEY Continuous Blowdown

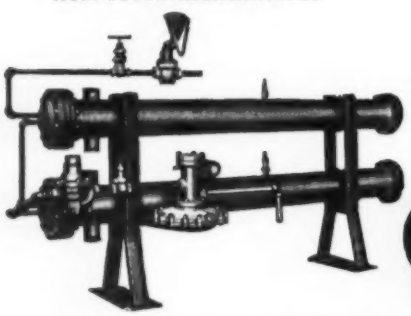


Provides Controlled

BOILER WATER CONCENTRATION

A Henszey Continuous Blowdown System will keep boiler water concentrations within safe margins — preventing foaming, priming, and the formation of sludge and scale (with proper chemical treatment). This absolute control of boiler water concentration is accomplished continuously, automatically, and without heat loss.

Check the advantages of Clean Steam and Low Cost Power in your plant — present or planned — then call Henszey for practical recommendations.



Contact your nearest Henszey representative or write to

HENSZEY COMPANY
Department D9
WATERTOWN WISCONSIN

HENSZEY

CONTINUOUS BLOWDOWN *and* BOILER PLANT SPECIALTIES

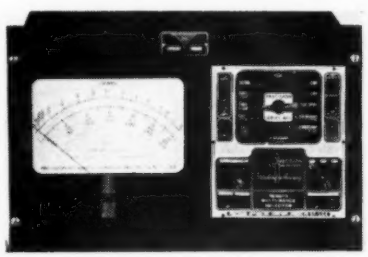
Boiler Feed Regulators • Distillation Systems • Heat Exchangers
Feed Water Meters • Flow Indicators • Proportioning Valves
also MILK EVAPORATORS and PREHEATERS

straight, 45- or 90-deg angle models. Adapters permit choice of material and calibration of thermocouples. Pyrometer is contained in a sealed, dustproof, aluminum case having a "pistol-grip" handle which may be locked in a horizontal or vertical position for ease of operation. A 3 9/16-in. reflector scale prevents parallax errors in reading.

Dual iron-constantan scales are calibrated from 0 to 600 F or 0 to 1000 F (with centigrade equivalents) and dual chromel-alumel scales are calibrated from 0 to 1600 F or 0 to 2500 F (with centigrade equivalents). Bare, *Marshall* or surface thermocouple tips may be selected. **Dept P, Wheelco Instruments Co, 847 W Harrison St, Chicago, Ill.**

Plug Valve

ESCO DUOSEAL cylindrical plug valve does not depend on metal-to-metal contact surfaces for tightness, but upon a special metallic gasket compound applied under pressure to key points in valve body and plug. Actually cylindrical plug fits body with a fairly generous tolerance and no metal-to-metal seal is obtained. Metallic gasket extruded by pressure through vertical grooves at four points on plug furnishes the seal in the valve, which is capable of holding drop-tight pressures as high as 25,000 psi. Valve is available in a full range of standard sizes and pressure series. **Dept P, Electric Steel Foundry, 2141 N W 25th Ave, Portland 10, Ore.**

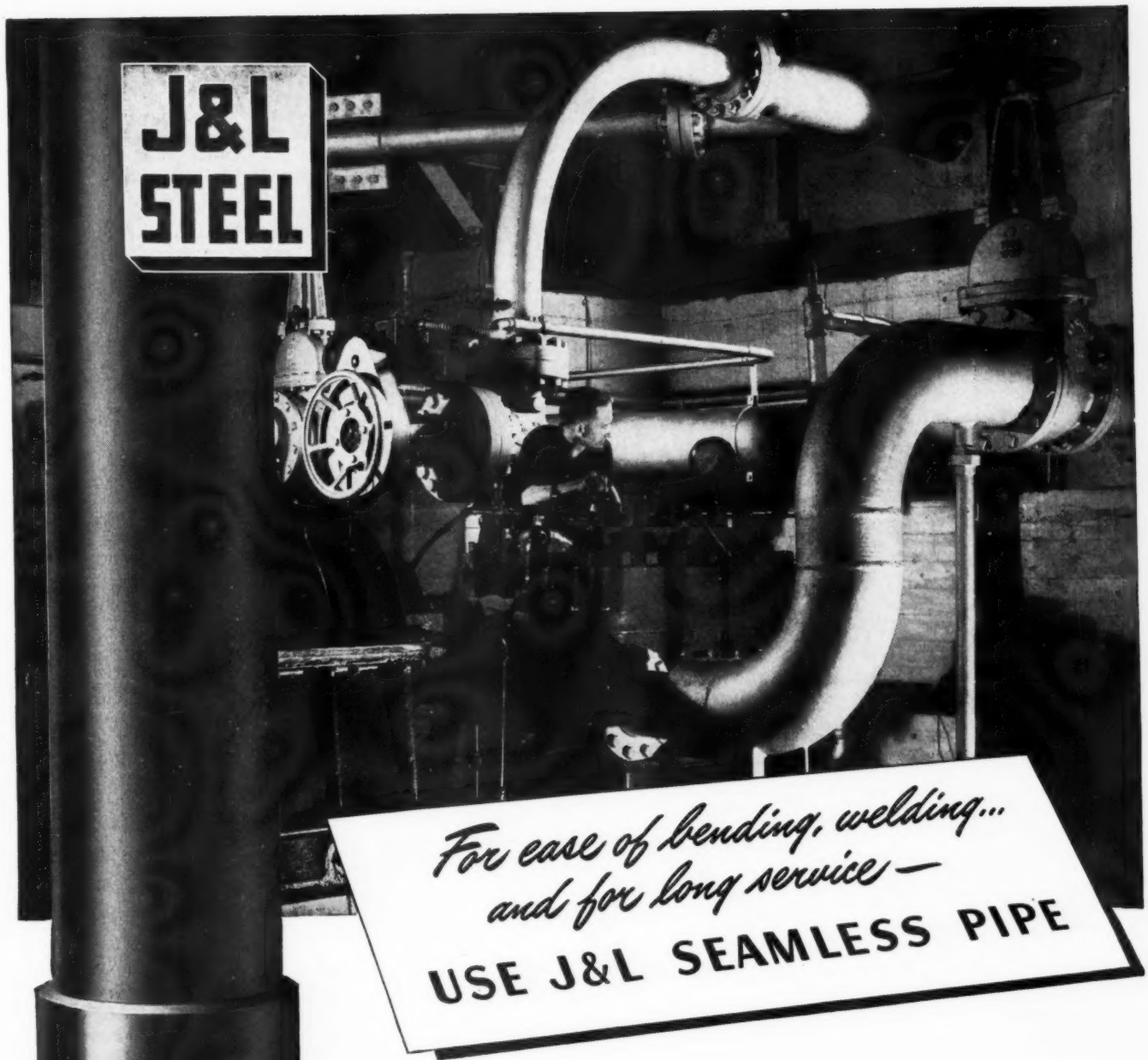


Laboratory Circuit Tester

SERIES 864 41-range, panel-mount, ac-dc laboratory circuit tester, incorporating a 9-in. rectangular 5000-ohms-per-volt meter, provides functions of an ac-dc voltmeter, ohmmeter, milliammeter, ammeter and decibel meter. It is housed in a standard 12¼ x19-in. panel with completely inclosed rear dust cover for standard relay-rack mounting. A wide selection of ranges is provided up to 6000-v ac and dc; 20 megohms, 12 amp, 70 db. **Dept P, Precision Apparatus Co, 92-27 Horace Harding Blvd, Elmhurst, N. Y.**

Materials-Handling Pump

RECENT IMPROVEMENTS in Hydroseal abrasive-materials-handling pump include: (1) Pump has new heavy-duty anti-friction radial and thrust bearings. These bearings are interchangeable. (2) It is now provided with an improved means for easy, 2-way axial adjustment of shaft and bearing assembly. (3) There is no rigid mounting of pump shell or engine side bell to pump base. Both are now supported from



For ease of bending, welding... and for long service—

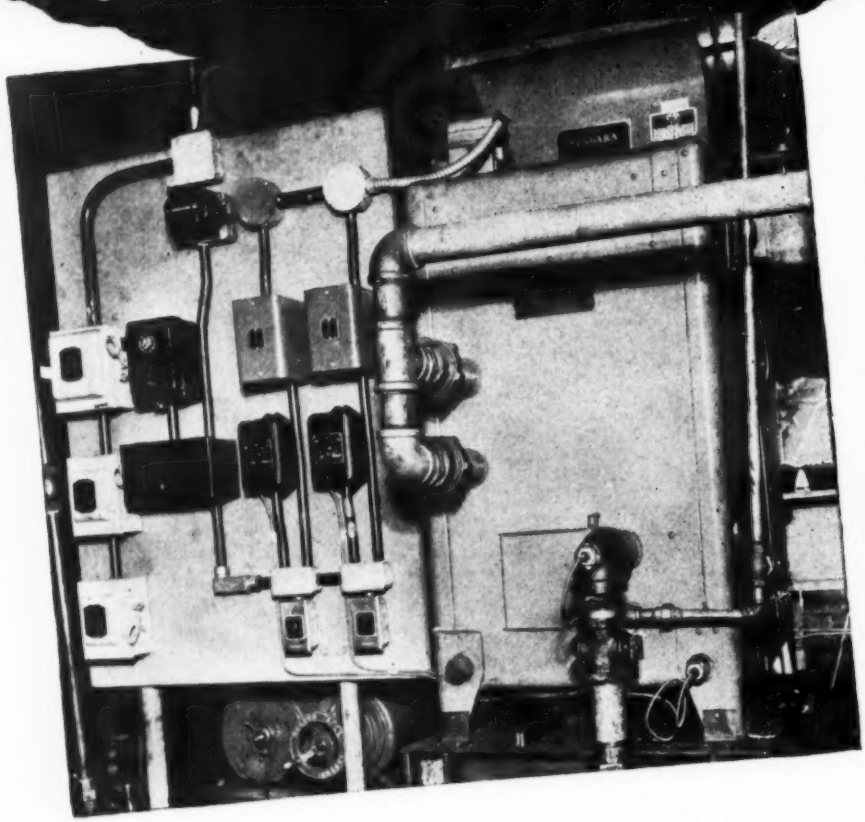
USE J&L SEAMLESS PIPE

J&L steel pipe is made of J&L Controlled Quality steel especially for bending and welding in power plant installations. The long experience and skill of J&L men enables you to obtain a pipe that has uniform wall thickness, is clean and straight for your most exacting installations. J&L steel pipe is made to give long and satisfactory service. Write for information.

JONES & LAUGHLIN STEEL CORPORATION

PITTSBURGH 30, PENNSYLVANIA

LET *Air* DO THE WORK OF COOLING



● The **NIAGARA AERO HEAT EXCHANGER** makes the atmospheric air take up the heat you want to remove from power equipment or industrial process. It is done by the evaporation of a small amount of water, removing 1000 BTU for every pound of water evaporated. With this method it is also easy to control temperatures closely . . . to assure accuracy in process results . . . speeding up production at lower cost.

Well designed and built to last, **NIAGARA AERO HEAT EXCHANGERS** have made an excellent record for reliability in service and freedom from maintenance trouble and expense.

Ask for Bulletin No. 96-P

NIAGARA BLOWER COMPANY

Over 30 Years of Service in Industrial Air Engineering

405 Lexington Ave. New York 17, N. Y.

Field Engineering Offices in Principal Cities

INDUSTRIAL COOLING HEATING • DRYING

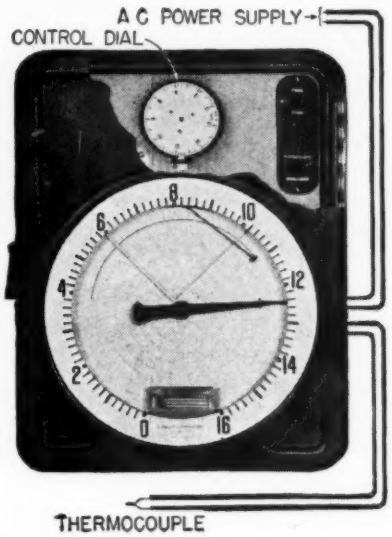
NIAGARA

HUMIDIFYING • AIR ENGINEERING EQUIPMENT

bearing housing. This permits pump discharge to be placed at any of the three positions indicated above. In many cases, this will simplify installation of discharge piping. Also, it eliminates "special pump" construction to obtain this result. **Dept P, Allen-Sherman-Hoff Co, 227 S 15th St, Philadelphia 2, Pa.**

Concrete-Floor Dusting

STONHARD STONTOP protects floors by sealing the surface. It penetrates and fills pores of concrete and, by chemical reaction with cement, hardens and fortifies surface against effects of acid, grease, oil and severe abrasion. **Dept P, Stonhard Co. 401 N Broad St, Philadelphia 8, Pa.**



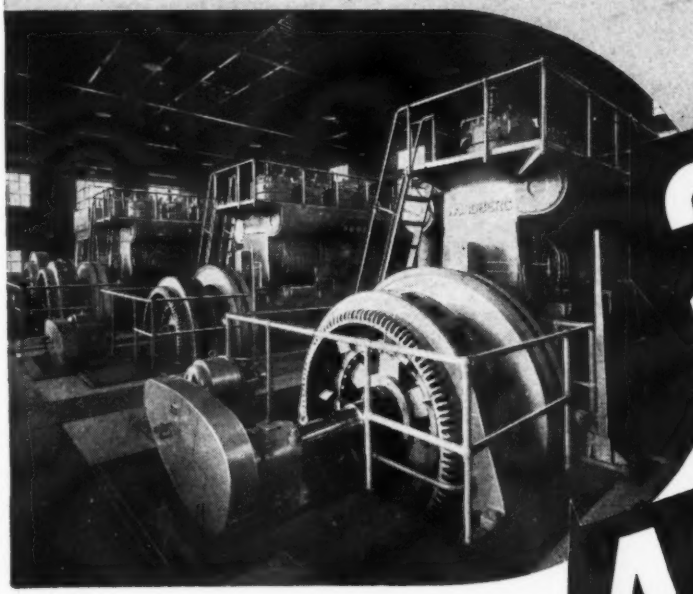
Potentiometer-Pyrometer

NEW ELECTRONIC POTENTIOMETER-PYROMETER has no continuously moving or vibrating parts in its measuring circuit. It records one or two temperatures on a 12-in. dia uniformly graduated chart and indicates on a 29-in. bold scale, which encircles the recording chart. This indicating, recording and controlling instrument requires a 115-v 60- or 50-cycle ac power supply. It operates from a thermocouple or from any source of dc potential, which varies through at least 10 millivolts for full-scale range. Conventional thermocouples are for temperatures up to 3000 F. For temperatures above 3000 F and for moving objects about 1500 F, radiation thermocouples are used. Instead of a galvanometer or millivoltmeter, the Bailey *Pyrotron-Potentiometer* circuit employs a dc to ac converter and an electronic detector to measure potentiometer unbalance. **Dept P, Bailey Meter Co, 1050 Ivanhoe Rd, Cleveland 10, O.**

Trash Racks and Rakes

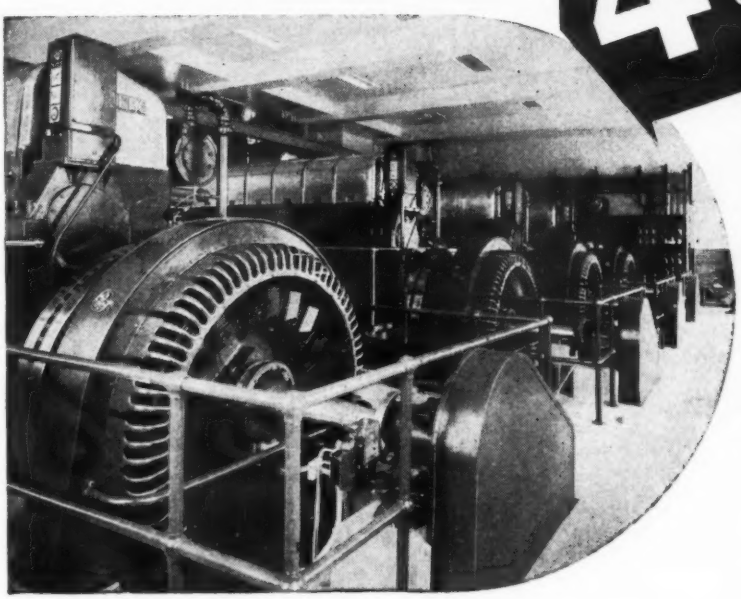
POWER-SAVER TRASH RACK has an improved all-welded back-bar construction. Vertical slats have no holes to weaken them, are spaced exactly to specifications by precise jigs and fixtures, and are welded into position so they cannot bend or twist. Racks are quickly installed in sections by tack welding or clipping and bolting ad-

A NORDBERG DIESEL will supply your power needs



2 CYCLE ENGINES
Available in sizes up to 8500 B. H. P. in a single unit.

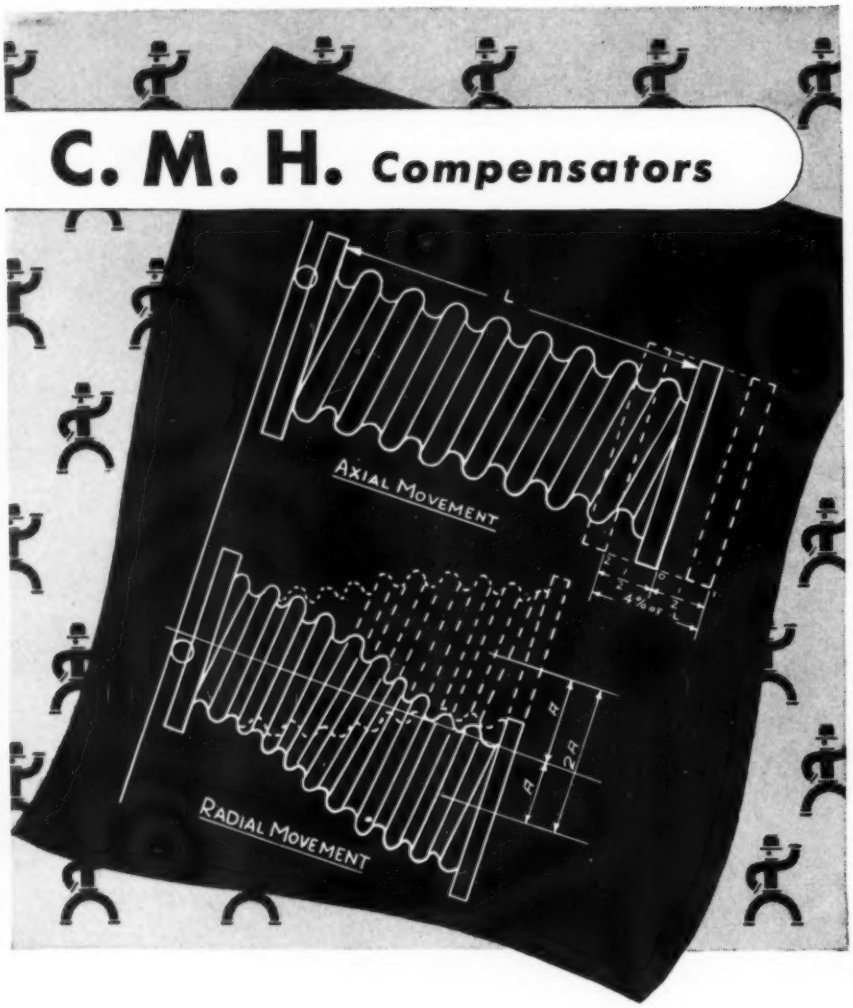
4 CYCLE ENGINES
Built in non-supercharged and supercharged designs in sizes up to 1600 B. H. P.



As a builder of both two and four-cycle oil or gas burning Diesel engines, Nordberg can supply the power needs of plants small and large and a type engine best suited to each requirement. Back of these engines is a record of many years of successful performance that has won for Nordberg a position of leadership in the Diesel power field. The many repeat orders from satisfied users attests to this fact. For dependable, low cost power, investigate the merits of Nordberg Diesels. Our engineers will gladly furnish further particulars on an engine to meet your power demands.

NORDBERG MFG. CO., Milwaukee 7, Wis.

NORDBERG
DIESEL ENGINES



• C. M. H. Compensators take up pipe line expansion : : : both in axial and radial planes, and, in addition, absorb vibration where motion dampening is needed. Multiple plane motions also are cared for.

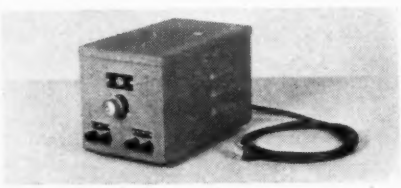
With their background of practical experience, Chicago Metal Hose engineers are well equipped to help you solve your compensator problems. Ask us for recommendations.

Flexible Metal Hose for Every Industrial Use

CMH
CHICAGO METAL HOSE CORPORATION
MAYWOOD, ILLINOIS
Plants: Maywood and Elgin, Ill.

joining back bars for a permanent installation that will not move or vibrate. Heavily covered with a specially developed water-resisting black asphaltum paint, the rack is fully protected against corrosion.

Power-Saver stainless-steel trash rake is said to be as strong and rigid as one piece of steel. Basket teeth are spaced to engage slats of the trash rack correctly and double-length guards prevent interference between teeth and back bar of trash rack. This rake head, combined with *Featherlite* tubular handle, provides a buoyancy "air chamber" and lightness to rake. It is not affected by moisture. Because of a self-lifting feature, it requires only a light pull to bring the *Power-Saver* buoyant rake to top of rack for easy unloading. **Dept P, Rodney Hunt Machine Co, Orange, Mass.**



Self-Balancing Potentiometer

COMPLETELY SELF-CONTAINED, portable self-balancing potentiometer, called an *autopot*, is an electric device for converting small dc voltages to measurable currents without appreciably overloading measured circuit. Among services to which the *autopot* may be applied are telemetering, temperature measurement, analysis of electronic circuits, constant current source, and measurement of unbalance in bridge circuits and drop across shunts where lead resistance is critical.

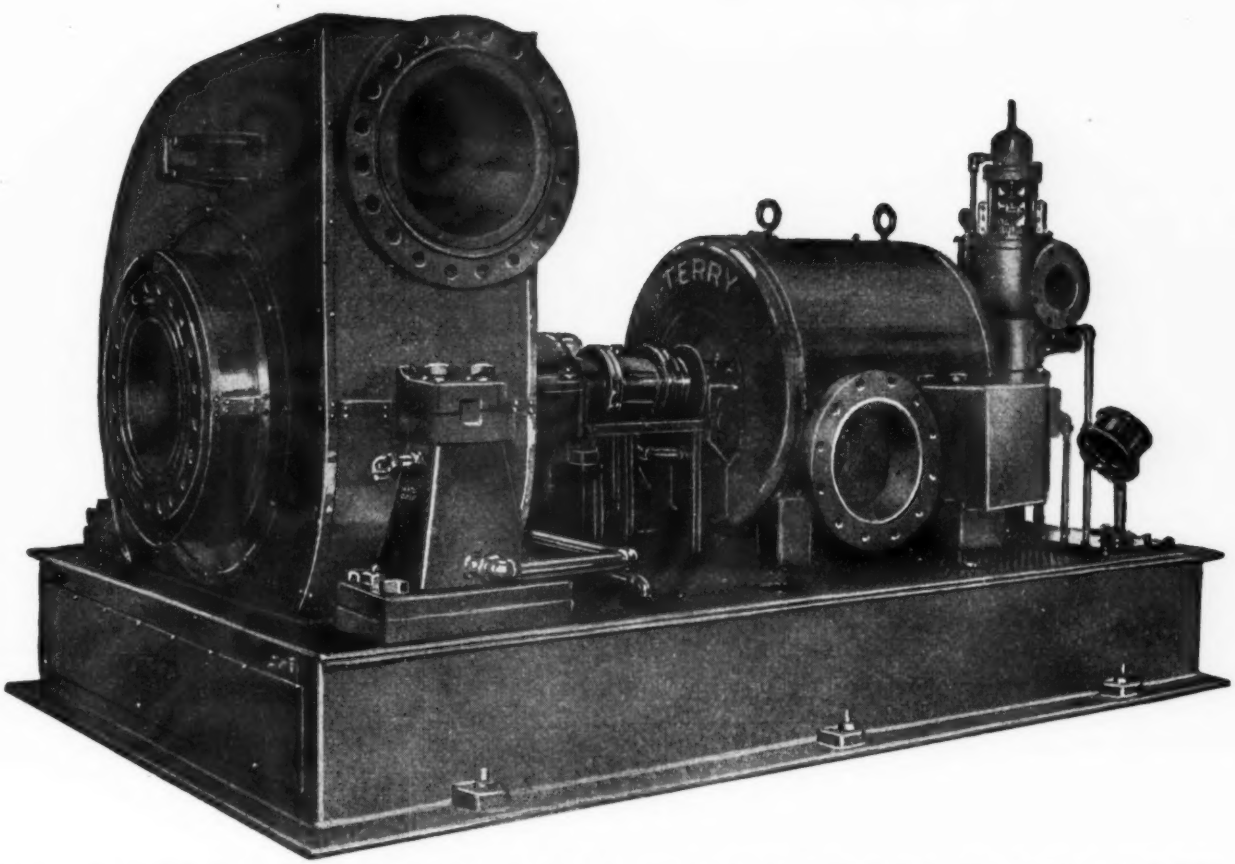
Another feature is its flexibility. Dc voltages as low as ten microvolts and up to one volt can be measured with any indicating or recording instrument drawing up to 5 milliamperes and having a resistance of 1500 ohms or less. Unit application also extends range of conventional indicating and recording instruments so they can be applied for high-sensitivity measurement of low dc voltages and direct currents. **Dept P, General Electric Co, Schenectady 5, New York.**

Piston-Repair Kit

COMPANY INTRODUCES a new development, which is claimed to be the answer to wear in top-ring groove of pistons. This consists of a contracting groove insert and a regrooving tool, which cuts a recess for the insert at same time that it trues up and widens top groove.

Sealed Power's regrooving tool makes the worn groove $\frac{3}{32}$ in. wider than original groove and cuts at the same operation a recess $\frac{3}{32}$ in. wide at top of groove. Into this recess is fitted the contracting groove insert, which anchors itself permanently. The insert is also made with a slight "dish" and is installed with dished side up, so that it hugs top side of groove and becomes an integral part of piston. It can't float about like a loose "spacer," but forms a spring-steel armor at base of top land, which is

The TERRY TURBINE



MULTI-STAGED TURBINES CAREFULLY ENGINEERED TO MEET YOUR REQUIREMENTS

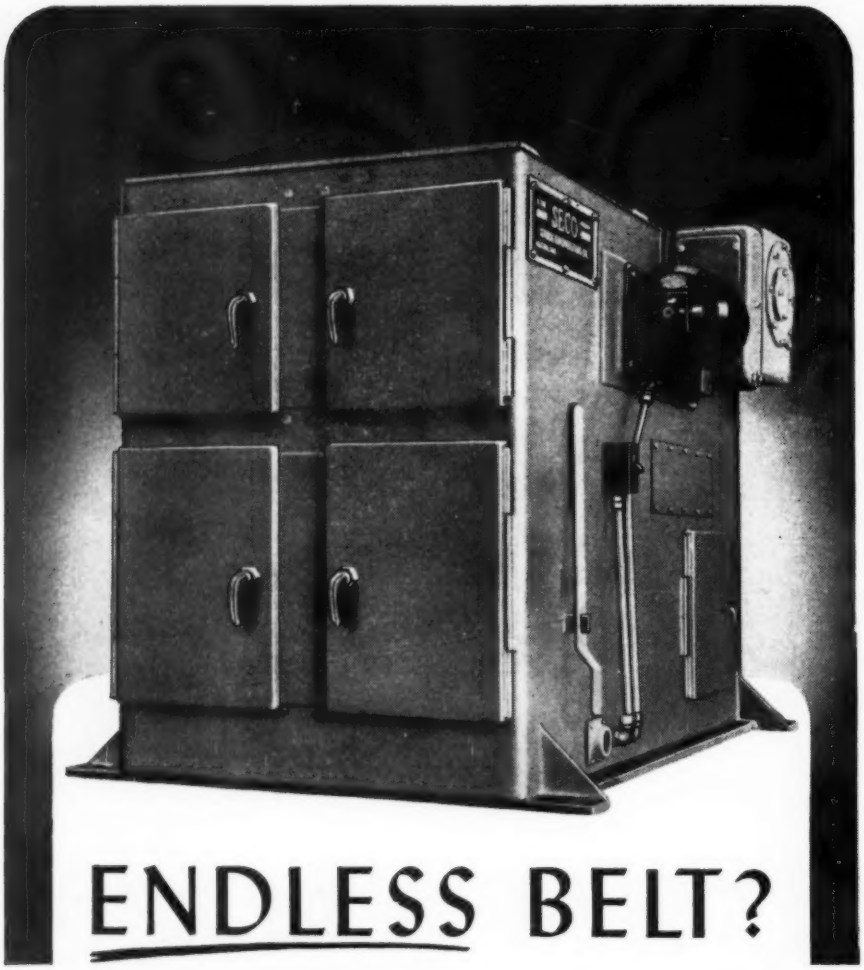
Each Terry Multi-staged Turbine is individually designed and proportioned in accordance with the plant conditions and requirements.

A typical unit is shown above direct connected to a blower. This turbine is rated 1200 H.P. at 6100 R.P.M. It is equipped with six stages and operates condensing. The governor is of the oil relay variable speed type. The lubrication system provides flood lubrication to the turbine and blower bearings.

If you have an application for a turbine — single staged or multi-staged — geared or direct connected — standard or special — in sizes up to 2000 H.P. — talk it over with Terry.

T 1162

THE TERRY STEAM TURBINE COMPANY
TERRY SQUARE, HARTFORD, CONN.

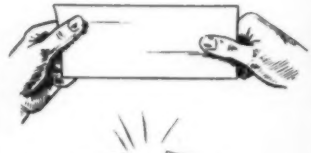


ENDLESS BELT?

● To see why S. E. Co. Coal Scales feature an endless belt, cut a slip of paper, measuring about 2"x6", to simulate an endless belt, and try to break it or tear it in two by pulling on it in opposing directions, as in Fig. 1. A good lateral pull will not break it. Now cut the slip of paper into two 3"x2" sections and staple or pin the pieces together end to end to simulate a fastened belt. A very slight pull will separate the pieces at the point where they are fastened, as in Fig. 2. The added dependability and strength of the endless belt is obvious . . . and that is just one of the many "extras" you get in a S. E. Coal Scale. For more information and points of interest about the S. E. Co. Coal Scale write to Stock Engineering Co., 715 Hanna Bldg., Cleveland 15, Ohio

Yes!

...make this test to demonstrate its efficiency to yourself!



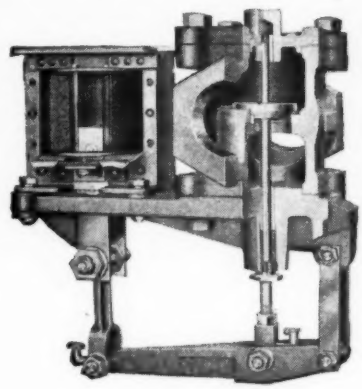
STOCK ENGINEERING CO.

★ CONICAL Non-Segregating Coal Distributors ★ S.E.CO. Coal Valves and Coal Scales

said to resist wear better than aluminum alloy or cast iron. It is equally effective in new pistons. **Dept P, Sealed Power Corp, Muskegon, Mich.**

Sleeve Seal

ELASTIC SLEEVE SEAL prevents rotary shafts in centrifugal, rotary, reciprocating and other pumps from leaking. According to tests, seal works equally well on bent, pitted or slotted shafts and eliminates springs and shaft glands. Seal bearing of sleeve seal is located at source of oil supply. **Dept P, Temperature Control Devices, Inc, New Haven 15, Conn.**



Solenoid Valve

COMBINING IMMEDIATE FULL FLOW with ability to operate under differential pressures as high as 150 psi, solenoid valve serves for all liquid-level control, with hot and cold water, steam, oil and other liquids.

This new Johnson valve is direct acting, not pilot operated. Lever arrangement provides ample power to insure positive opening of valve. Single-seat construction eliminates possibility of silt or other foreign matter freezing piston. This construction also is claimed to increase temperature range. Valve handles hot liquids or steam up to 365 F. Designated as a globe-screwed valve, it is for heavy-duty service. Valve body is of cast iron or bronze, with top cap and bottom sections bolted to body. Valve, seat and valve stem are all of stainless steel.

Johnson valve is available in two series. Type *HH*, sizes from ½ in. to 1½ in., is suitable for differential pressures ranging from 125 to 150 psi; Type *HL*, sizes 1 to 3 in., is for medium- and low-differential pressures. Standard models are for operation at 110- 220- or 440-v 60-cycle current. **Dept P, Johnson Corp, Three Rivers, Mich.**

Packaged Arc-Welder

VEET ARCWELDER is complete with all necessary equipment self-contained in a single easy-to-move unit. Machine is available in a 150- to 200-amp and a 300- to 400-amp size, with the same features.

Single-control wheel provides infinitely variable control of welding current. Fin-cooled transformers, incorporating eight heavy-duty coils, are said to provide for

(*Continued on page* 178)

THE IMPOSSIBLE

.....TOOK A LITTLE LONGER

FOR more than 35 years, the makers of American Metal Hose have consistently introduced new forms of flexible connectors — complete with fittings — to do complicated and still more complicated types of work. Connectors that had to possess qualities of extreme flexibility and yet be able to move up and down or back and forth literally thousands of times per day while carrying vapor or liquids under high pressures — these were "the difficult" run of the mill problems.

The "impossible" came to us at the beginning of World War II when we were requested to develop a flexible wave guide — shown above — rectangular in shape, flexible on both axis, made from laminated silver bronze, absolutely tight electrically, jacketed with molded synthetic that would adhere perfectly to the metal — *all* held to extremely close tolerances. It is a tribute to the skill and imagination of our engineers that literally thousands of these Flexible Wave Guides were installed in the radar systems used by both the Army and Navy.

Serving as Flexible Wave Guides in installations of micro-wave equipment is just one example of the almost impossible things that can be done with properly designed connectors of American Flexible Metal Hose and Tubing. As a round, oval shaped or rectangular flexible duct for air; as a flexible line for carrying steam or oil, wet or dry chemicals, or hundreds of other gases, liquids or semi-solids, American Metal Hose is a practical and economical answer.

If your problem is similar, you'll be interested in getting the story of this Miracle in Metal. A catalog will be sent on request.

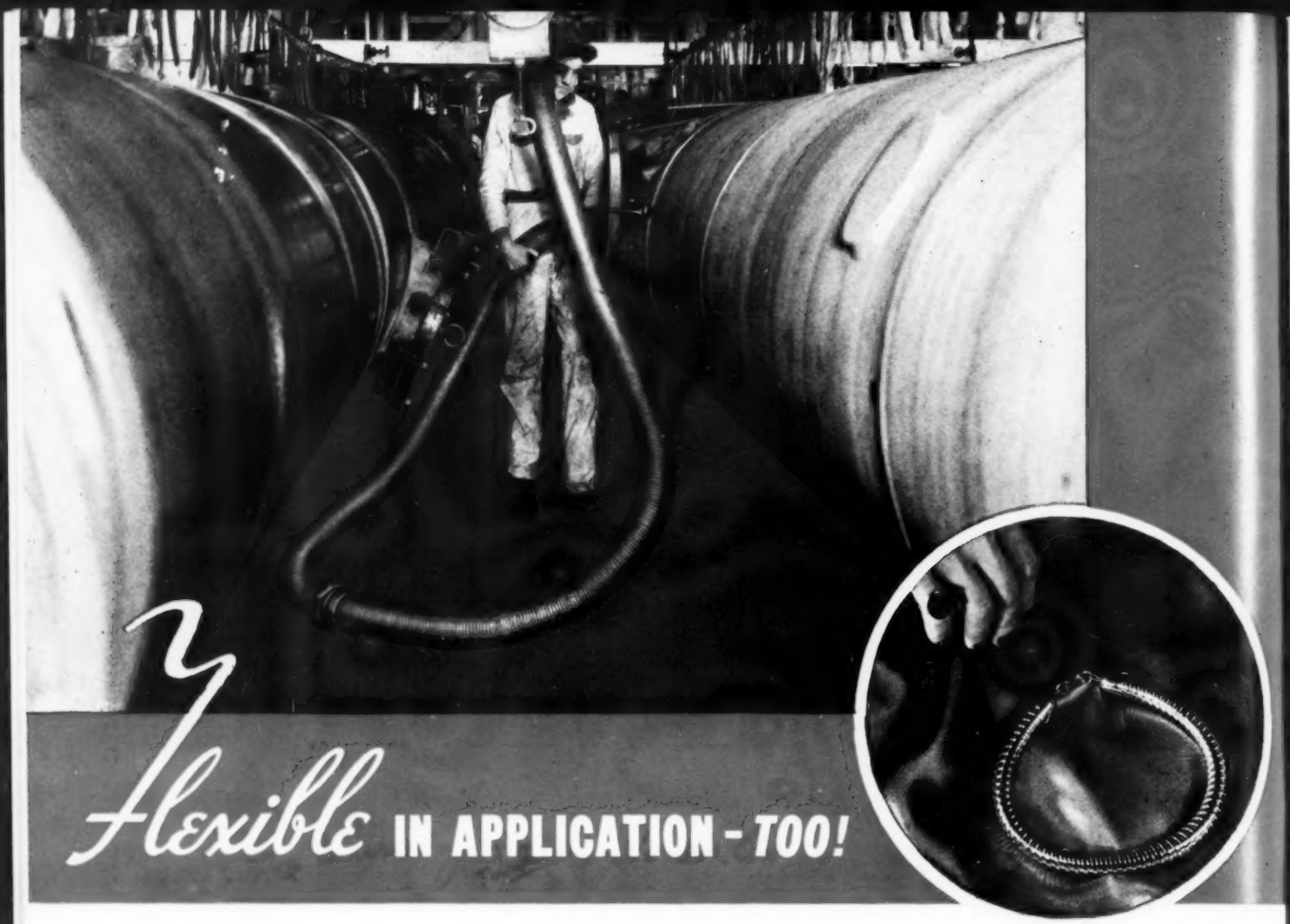
American Metal Hose

THE AMERICAN BRASS COMPANY — AMERICAN METAL HOSE BRANCH

General Offices: Waterbury, Conn. Subsidiary of Anaconda Copper Mining Company

In Canada: Anaconda American Brass Ltd., New Toronto, Ont.

ANACONDA



Flexible IN APPLICATION - TOO!

FLEXIBILITY is naturally a most important physical characteristic to be "built-in" to every length of American Metal Hose. But flexibility is also tremendously important as it concerns application by the user. For instance, many of our customers use the same length of American Metal Hose for *both* heating and cooling purposes — bronze steam hose, which is called upon to handle saturated steam one moment, and cold cooling water the next. And, strangely, this same length can be converted to a flexible oil line on an instant's notice.

The range of duties that can be performed by American Metal Hose is typically illustrated above. The large photo shows a length of flexible interlocked steel hose used for handling a bran mold in the manufacturing of penicillin — a transfer problem where a dependable, rugged flexible all-metal connector was the only logical answer.

The small illustration shows the other extreme in application — square-locked brass conduit which was gold plated and fitted for application as ladies' necklaces.

Regardless of how tough your requirements may seem, American Metal Hose engineers would welcome an opportunity to make suggestions. A problem that involves a combination of vibration, pressure, continuous flexing and high heat calls for a rugged flexible connector that is engineered "right" from the start.

We'll be glad to send a catalog.

46337

American Metal Hose

THE AMERICAN BRASS COMPANY — AMERICAN METAL HOSE BRANCH
General Offices: Waterbury, Conn. Subsidiary of Anaconda Copper Mining Company
In Canada: Anaconda American Brass Ltd., New Toronto, Ont.

ANACONDA

Make THIS Blue Print FIRST

Avoid costly errors with any type of COMBUSTION EQUIPMENT

ASSURE FUEL FLEXIBILITY

1ST. ECONOMIC ANALYSIS

Make a Fuel Investigation to determine the coals which will be economically available to your plant for at least the next 25 years, considering reserves, production costs, quality and reliability.

2ND. BITUMINOUS COAL SPECIFICATIONS

Make "Bituminous Coal Specifications for Combustion Equipment" your "first blue print." Tabulate on this form the average quality, characteristics and sizes of at least four coals from different producing districts. These coals should constitute the range of coals to be used for generating low cost steam during the life of the plant.

From these average data establish the Combustion Equipment Design Factors, using sufficient tolerances to cover normal variations in quality. It is a costly error to purchase new equipment which is inadequate to burn the range of coals economically available.

3RD. COAL ANALYSIS

Select representative mines in the producing districts shown in the "first blue print," and estimate the probable delivered costs on a B.T.U. basis. For this purpose consider transportation costs, current prices, basic production costs, price trends, and the effect of mine mechanization on future price relationships. Design the plant to use efficiently the coals that have the best competitive future.

FAIRMONT LOW FUSION COAL MEETS EVERY REQUIREMENT FOR LOW COST STEAM GENERATION

. . . it can be burned economically in any equipment properly engineered for its use . . . huge reserves extend the availability of this coal into the far distant future . . . it usually represents "the best value for the fuel dollar" for long range planning. . . . engineering to use FAIRMONT COAL assures the lowest overall steam cost for the life of the plant.

MAIL COUPON

FAIRMONT COAL BUREAU, Chanin Bldg., 122 E. 42nd St., New York 17, N. Y.

1. Return this coupon for a copy of the form "Bituminous Coal Specifications for Combustion Equipment."
2. Place my name on the mailing list for Fairmont Coal Bureau Reference Bulletins. 1. ☐ 2. ☐ (Indicate desires by checking squares.)

NAME.....POSITION.....

COMPANY.....

STREET ADDRESS.....CITY.....Zone.....State.....

FAIRMONT COAL BUREAU · FAIRMONT REGION · WEST VIRGINIA · SERVICE TO INDUSTRY ·

P-946

Ludlow Fig. 1581, Flanged Wedge Gate Valve with OS&Y. Cast Steel exceeds minimum requirements of A.S.T.M. Maximum temperature 750° F. Tested at 350 lbs. Also available with butt welding or screwed ends.

FOR A **POSITIVE SEAL**

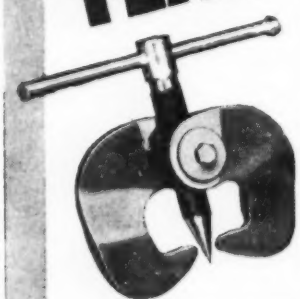
—you'll want to use Ludlow Cast Steel Wedge Gate Valves. In applications of steam, water, gas and oil, the Ludlow Wedge-Gate principle exerts an evenly balanced pressure that positively seals both seats. Furnished with various trim materials, resists attack from corrosive fluids. Specifications and prices are yours for the asking.

V-12

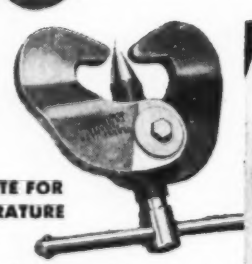
The **LUDLOW VALVE** SINCE 1866
MFG·CO·INC·TROY·N·Y·

Schedule your shut-downs with **FLANGE JACKS** ••••••••

on any pipe line gasket replacement!

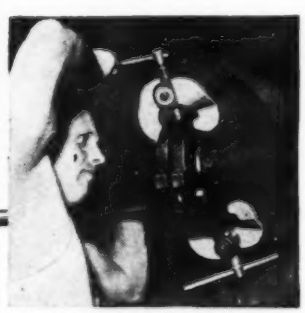


The only tool that takes the guesswork out of replacing gaskets, regardless of line pressure or location. Flanges are parted quickly and held in perfect alignment without damage to faces . . . shock and jarring of pipe lines are eliminated . . . there is no danger from flying wedges . . . no sparks caused by hammer blows. Flange-Jacks eliminate costly shutdowns, make possible fast, economical repairs in hard-to-get-at locations . . . offer maximum safety.



WRITE FOR LITERATURE

Write Dept. N for details or see your nearest distributor



MAXIMUM PROTECTION to personnel and plant!

FLANGE JACKS are vital when replacing gaskets in presence of oil or gas fumes . . . eliminates hammer blows and sparks. FLANGE JACKS are a "must" in safety engineer specifications.

T. G. PERSSON COMPANY ••••••••
224 GLENWOOD AVE., BLOOMFIELD, NEW JERSEY

trouble-free operation. According to manufacturer, machine can be adjusted to afford a spatter-free smooth arc for welding work ranging from a light gage sheet up to a locomotive frame.

Welder is supplied complete with electrode and ground cables, ground clamp, helmet and assortment of welding rods. Steel cabinet, measuring 25x18x30 in., is equipped with ball-bearing 4-in. casters and bar-lifting handles. **Dept P, Veet Co, 25757 Groesbeck Highway, East Detroit, Mich.**

Sand Filter

FOR CLARIFICATION of boiler feedwater and treatment of thickener overflow, automatic-backwash rapid sand filter consists essentially of a specially compartmented sand bed with underdrains, together with a suitable backwash and cleaning mechanism traveling on tracks on sidewalls of filter tank and actuated electrically at predetermined differences in head. Filter can be supplied in sizes varying from 3 to 16 ft in width and lengths to suit local conditions. Usual range in length is from 10 to 100 ft or more. **Dept P, Hardinge Co, York, Pa.**

Electric Hand Lamp

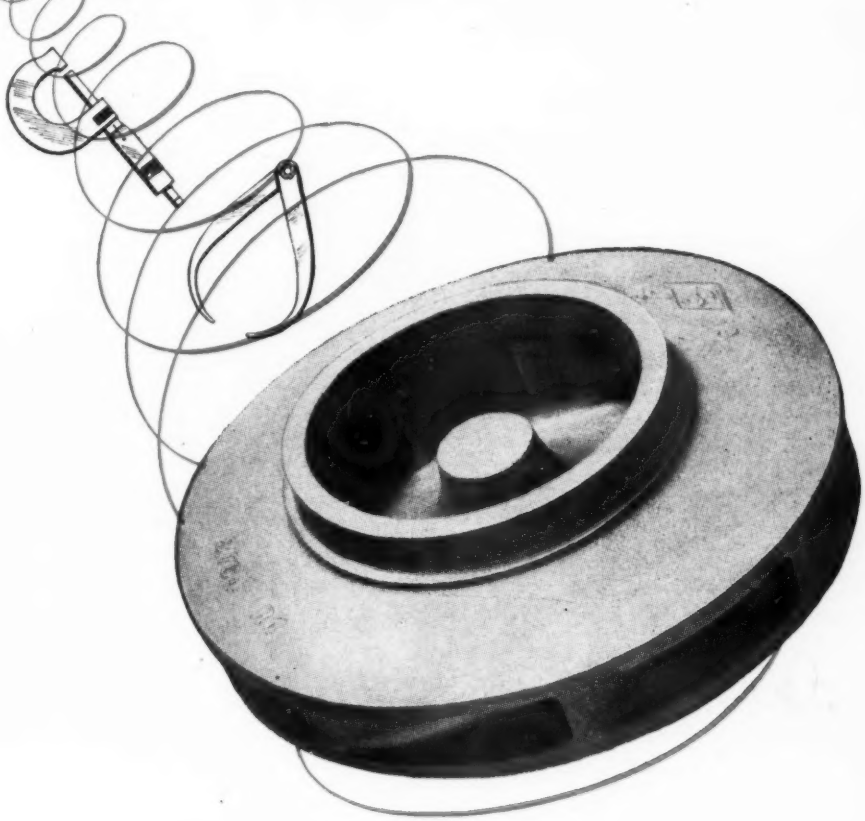
BIG BEAM NO. 211 portable weatherproof electric hand lamp has a single focus adjustment whereby it delivers a spot or spread light—a brilliant 1500-ft beam or bright localized light. It is powered by two standard dry-cell batteries with pressure connections. Weighing only 7 lb, it can be set down anywhere or clamped in a special hold-down fixture. **Dept P, U-C Lite Mfg Co, 11 E Hubbard St, Chicago 11, Ill.**

Magnetic-Field Gage

NEW MAGNETIC-FIELD GAGE indicates relative strength of magnetic field in parts which are being examined for flaws by magnetic-particle method of testing. The instrument is especially applicable for testing large castings and forgings in which it is difficult to calculate field intensity at various points from current passed through the part and cross-sectional areas.

This instrument measures ac and dc field strength. Small and portable, it serves wherever 115-v 60-cycle power is available. Instrument consists of a gage head that is permanently attached to a field-strength-

Proper **FINISHING...**

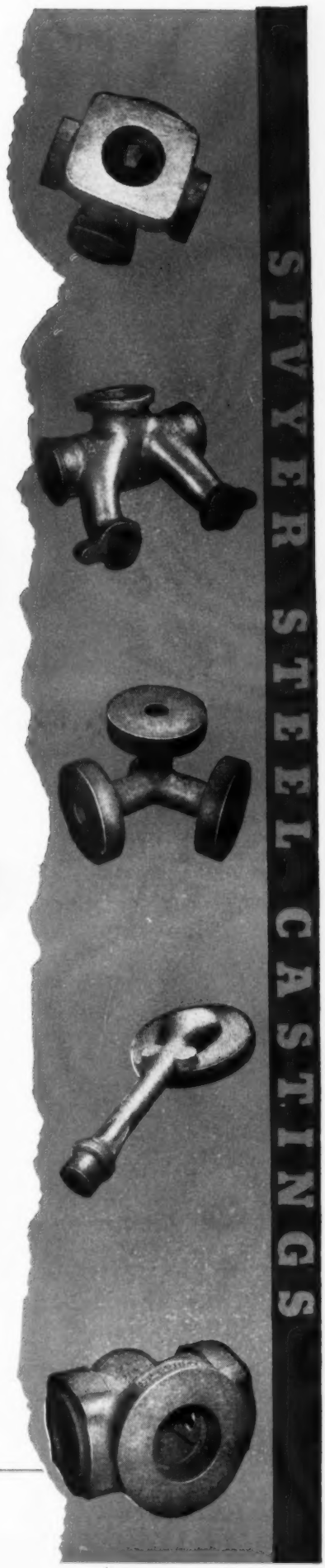


means **A QUICKER BEGINNING!**

Sivyer goes beyond the point of usual foundry practice in finishing castings for *greater* dimensional accuracy . . . correct size, shape and contour. Thus, Sivyer castings get on the job faster.

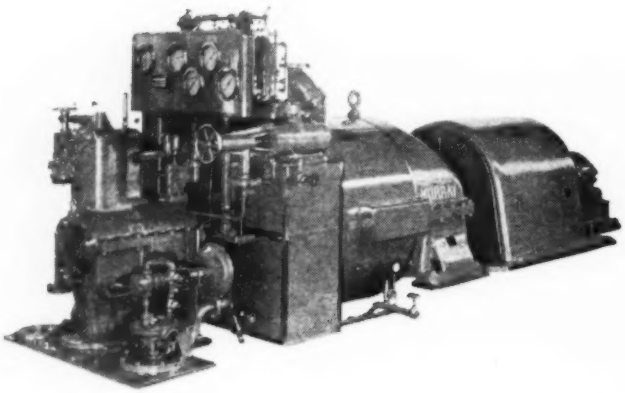
This means less handling . . . less processing of castings on your end. And once they are on the job, by the same token of taking time to make a sounder product, Sivyer castings stay there *longer.*

Dimensional accuracy is just another reason why critical buyers specify castings bearing the Sivyer diamond Ⓢ —the mark worth looking for. The next job— simple or difficult—give Sivyer a trial.



SIVYER STEEL CASTING COMPANY
MILWAUKEE Ⓢ CHICAGO Ⓢ

MURRAY
STEAM TURBINE GENERATING UNITS



Installed in 1939 in a small municipal power plant in northeastern Indiana, the above 500 KW direct connected Murray steam turbine generator set has given its owner entire satisfaction. The turbine is equipped with every device necessary for minimum of attention including steam turbine driven auxiliary oil pump. The generator and exciter may be furnished to match existing electrical equipment in your plant.

Units in this size may be furnished either direct connected or geared as preferred with performance and operation equally trouble-free.

There is a Murray representative ready to help you with design and layout information.

MURRAY *also produces*

Mechanical Drive Turbines — Horizontal and Vertical Reduction Gears of the high speed type Steam Boilers

MURRAY IRON WORKS COMPANY
BURLINGTON, IOWA
Builders of Steam Power Equipment for Three Quarters of a Century

indicating unit. The head consists of small coils wound around a U-shaped laminated metal core mounted in a plastic handle. Pole shoes are attached to ends of core and these make contact with piece being tested.

On front of indicating unit are mounted an indicating instrument with two scales, two selector switches for ac or dc, and an on-off switch. Instrument scale is calibrated in field units that are related to magnetic-field strength. **Dept P, General Electric Co, Schenectady 5, N. Y.**

Water Strainer

BRASSERT AUTOMATIC SELF-CLEANING STRAINER removes fine suspended particles from raw or process water and disposes of these particles in a continuous, automatic and self-cleaning manner. Strainers are built in 3- to 30-in. pipeline sizes. Strainer consists essentially of a slowly rotating conical drum, mounted on a vertical shaft, within a cast-iron housing. Entire surface of drum is drilled to receive straining media, which consists of porcelain disks, or flat, or conical wire stainless-steel screens. **Dept P, S P Kinney Engineers, Inc, 233 Oliver Ave, Pittsburgh 22, Pa.**

Boiler Circulatory System

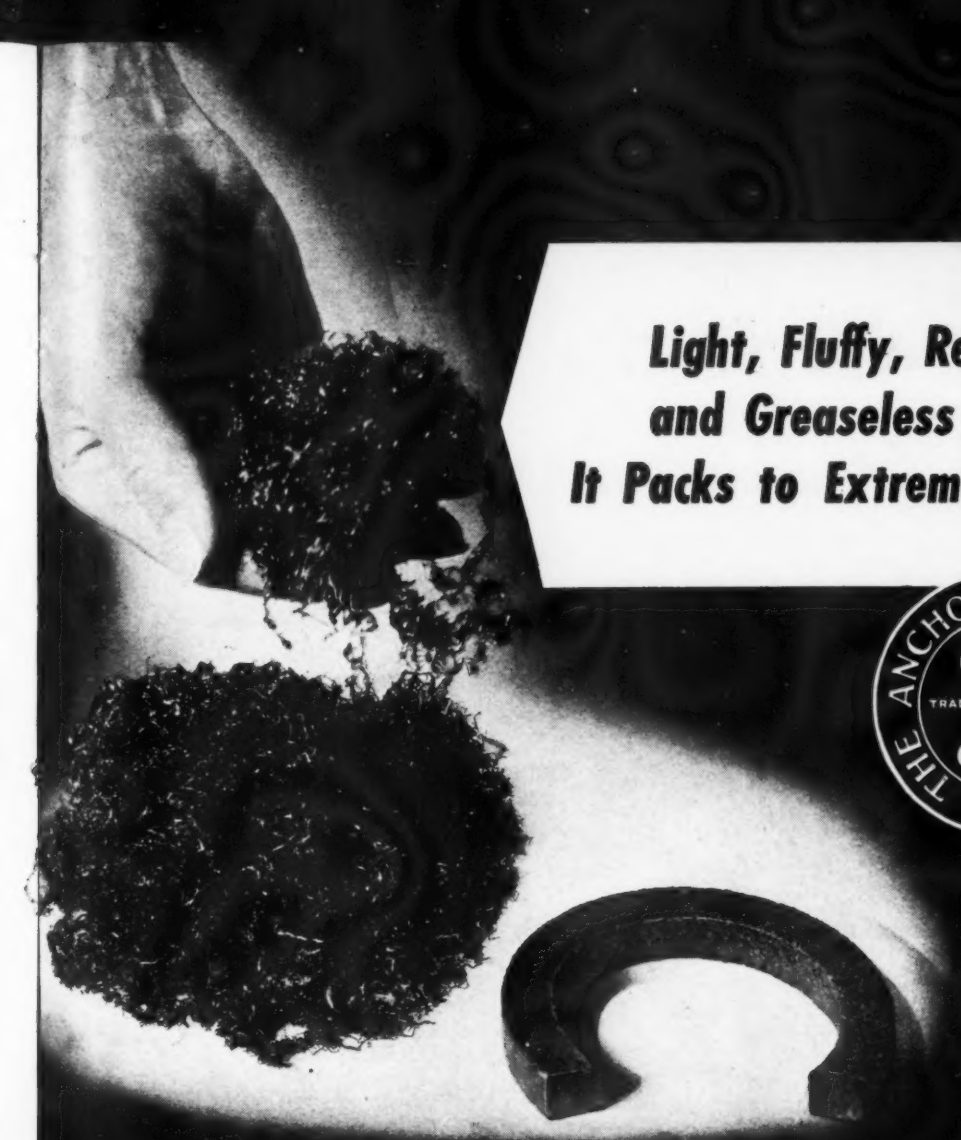
BOILER CAPACITY can often be increased without expense of new buildings, fuel storage or ash-handling equipment, by redesign of existing units in accordance with principles of Badenhausen circulatory system. Rearrangement of tubing, installation of proper headers and addition of waterwalls, it is claimed, improve circulation and increase radiant-heat absorption, thus boosting capacity. Each case is analyzed individually, giving proper consideration to several factors involved in securing desired capacity increase. **Dept P. John Phillips Badenhausen, Inc, Packard Bldg, Philadelphia 2, Pa.**

Goggle Valves

BAILEY MECHANICAL GOGGLE valves are now made in sizes from 72 in. down to 6 in., including totally inclosed designs. Flanges are heavy cast steel, valve and diaphragm plates rolled steel, and operating lever forged steel.

Simply flexing diaphragm plates in one direction releases valve from goggle plate, allowing it to swing freely to either position. Flexing in other direction activates powerful clamping device, which clamps goggle plate in a gas-tight seal between flanges. Double diaphragm plate conceals all operating parts. No levers, gears, or other moving parts come in contact with gas stream. For safe indoor installations, goggle plate can be furnished inclosed in a steel-plate housing, which prevents escape of gas to atmosphere when plate is swung.

Goggle plate on all sizes from 42 to 72 in. in dia is swung by a sprocket wheel, which engages the chain, welded at each link to circumference of plate. Sprocket wheel in turn is operated by a hand chain, which swings plate to open or closed position. One hand chain flexes diaphragm plates,



Light, Fluffy, Resilient and Greaseless . . . Yet It Packs to Extreme Density!

THE ANCHOR PACKING CO. TRADE MARK

CARBONITE PACKING

Carbonite Packing in coil form! It's easy to use . . . rings are easily cut . . . and it's unique in that it contains no oil, grease, wax or tar.

Ingredients used—asbestos and graphite—will withstand the highest temperatures of any organic or mineral substances . . . can be used in temperatures as high as 750° F. Each fiber is treated with a dry binder, making the packing soft, fluffy and perfectly dry.

Carbonite Packing is recommended for use on centrifugal pump shafts, high or low speed; rotary rods or shafts; reciprocating rods and plungers; expansion joints; valve stems; and numerous other uses against air, oil or water.

There are many advantages in using Carbonite Packing. Write today for these details.

THE ANCHOR PACKING COMPANY

GENERAL OFFICES: PHILADELPHIA, PA.

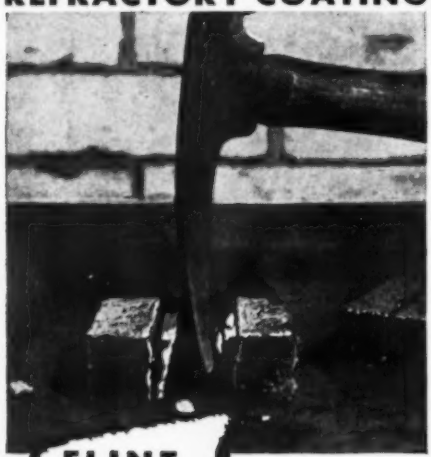
FACTORIES: MANHEIM, PA., ELKHART, IND., MONTREAL, CAN.

BRANCH OFFICES

Baltimore, Maryland . . . Boston, Massachusetts . . . Buffalo, New York . . . Cleveland, Ohio . . . Columbus, Ohio . . . Chicago, Illinois . . . Cincinnati, Ohio . . . Detroit, Michigan . . . Houston, Texas . . . Kansas City, Missouri . . . Los Angeles, California . . . Montreal, Canada . . . Milwaukee, Wisconsin . . . New Orleans, Louisiana . . . New York, New York . . . Philadelphia, Pennsylvania . . . Pittsburgh, Pennsylvania . . . Portland, Oregon . . . San Francisco, California . . . Seattle, Washington . . . St. Louis, Missouri . . . Tulsa, Oklahoma . . . Wilmington, California

BRICKSEAL

REFRACTORY COATING



FLINT HARD WHEN COLD

Brickseal becomes flint hard as it cools — protects walls from damage.

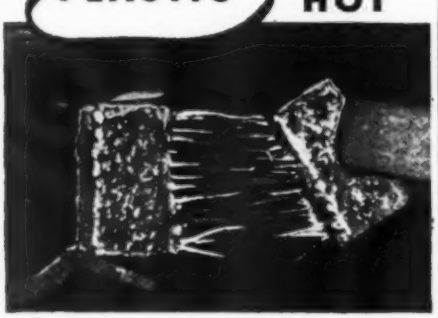
APPLIED LIKE PAINT—Brickseal, a combination of high fusion clays and metal oxides, protects refractories . . . preserves brickwork . . . prevents cracking, spalling and flame abrasion.

When heated, Brickseal deeply penetrates the pores and joints of the bricks and forms a highly glazed ceramic coating for refractory walls.

Brickseal is also used as a bonding material; it produces a tight brick-to-brick joint and welds the wall into one solid unit. Write for illustrated booklet; ask for a demonstration.

Brickseal is semi-plastic when hot allowing it to expand and contract with the furnace

SEMI-PLASTIC WHEN HOT



BRICKSEAL

REFRACTORY COATING

5800 S. Hoover St., Los Angeles, Calif.

1029 Clinton St., Hoboken, N. J.

thereby unclamping the seats, and the other chain swings goggle plate. On all sizes from 6- to 36-in. dia, plate is swung from a pivot axis by wheel and hand chain or lever. **Dept P, William M. Bailey Co, Pittsburgh, Pa.**

Oil Meter

TRANSOMETER MAKES POSSIBLE controlling, integrating, remote indicating and recording of heavy fuel oil. A combination of a piston-type positive-displacement meter and a pneumatic signal transmitter, the *Transometer* is equally valuable with other liquids, particularly viscous fluids because its accuracy is unaffected by viscosity changes. It is ideal for applications where wide flow variations are encountered. **Dept P, Askania Regulator Co, 1603 S Michigan Ave, Chicago, Ill.**

Resurfacing Tool

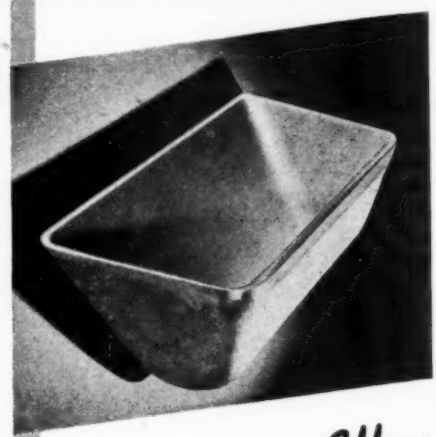
NEW MECHANICAL TOOL resurfaces all contact points and screws in magnetos, distributors and other electrical units. Tool consists of two major parts—a holding ring and a revolving, resurfacing plate. Original contact points are rigidly held in their proper holes in holding ring by a holding screw. Rotating resurfacing plate, equipped with a special abrasive disk, produces a clean, square point that insures good electrical contact. Each tool comes with two feeler gages, two extra abrasive disks and an electric drill adapter that replaces handle for power operation. **Dept P, Edison-Splitdorf Corp, West Orange, N. J.**

Block Repair Equipment

K & W METAL APPLICATOR speeds up repair of cracked engine blocks. Fewer pins are employed in lacing the crack, and after these pins are peened, applicator fills remainder of channel with proper metal, according to maker, in less time than is required for drilling, tapping and peening if pins were lined along entire length of channel. In addition, applicator fills blow holes in castings, brazing and soldering. This makes it a multipurpose machine that may be used for work as well as block repairs.

Contained in a sturdy metal case of compact design, with compartments for storage of cables, metal applicator is moved easily from job to job. To the transformer are connected an electrode cable, which leads to the electrode holder, and a ground cable, connected to a heavy-duty bronze clamp that is fastened to work. A vibrating electrode holder may be had in place of the standard holder, permitting faster application of the metal. Nickel, bronze and

PROMPT SHIPMENT



Aluminum Alloy

Elevator

BUCKETS

• Here's the solution to your elevator bucket problem—and, a better one at that. These aluminum buckets can be alloyed and constructed to your job specifications. Important, too, is their resistance to corrosion and abrasion. And, of course, their light weight means the attainment of greater capacities without an increase in power.

Many other castings in the Beaumont-Birch line also are now available in aluminum alloys. Write for details, today!

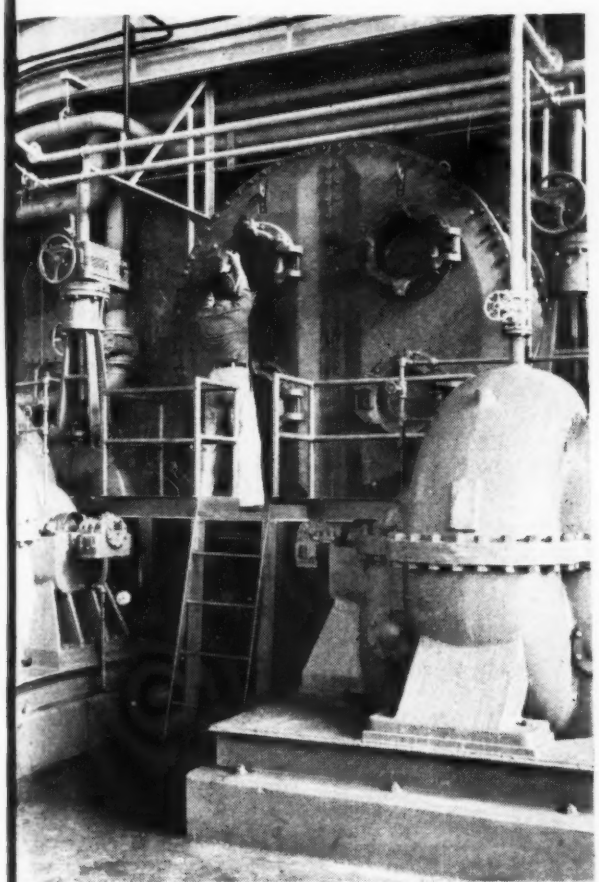
BEAUMONT BIRCH COMPANY

1502 Race Street • Philadelphia 2, Pa.

Designers Manufacturers Erectors

BULK MATERIAL HANDLING SYSTEMS

DOWELL



DOWELL INCORPORATED • TULSA 3, OKLAHOMA

Subsidiary of The Dow Chemical Company

New York • Philadelphia • Baltimore • Buffalo • Cleveland • Cincinnati
Chicago • Detroit • St. Louis • Houston • Kansas City • Wichita
Pittsburgh • Mt. Pleasant, Michigan • Salem, Illinois • Lafayette, Louisiana
Long Beach, Casper: Dowell Affiliate—International Cementers, Inc.

Original efficiency restored

—with Dowell chemical cleaning!

Leading plant engineers rely on the Dowell *chemical* method of removing scale and sludge from heat-exchange equipment—to restore rated capacities, to meet production schedules, and to maintain peak loads over long periods of time.

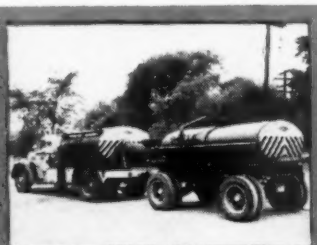
Dowell offers a complete service—including preliminary inspection, scale analysis, and the selection of proper chemicals to accomplish rapid cleaning. Dowell specialists bring with them adequate equipment to control every stage of the successful treatment.

Call the nearest Dowell office for a free estimate. Ask for "More Power to America's Industry"—free color booklet which explains Dowell's thorough Chemical Cleaning Service.

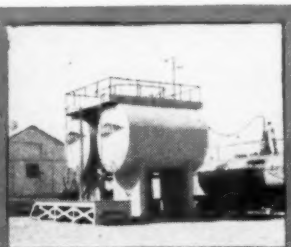
FREE SHOWING! Now available—a new 18-minute sound slide film illustrating the possibilities of Dowell Chemical Scale Removal Service. A Dowell representative will gladly arrange a special showing at your plant, office or organization meeting. Call or write Dowell today.

SPECIALISTS IN CHEMICAL CLEANING SERVICE

Dowell's experienced industrial engineers are backed by the complete research and technical facilities of The Dow Chemical Company.



Dowell's equipment is modern and complete—scientifically designed. Treating stations and chemical warehouses conveniently located.

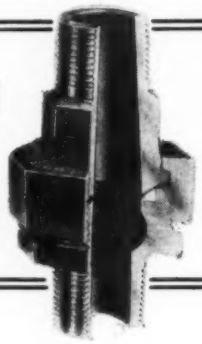


Dowell cleaning solvents are "tailor-made" to fit each job. All ingredients are of the highest quality, chosen for best results in your plant.

DOWELL

FOR INDUSTRIAL CHEMICAL SERVICE

JEFFERSON
Specialty
UNIONS



. . . with the
RECESSED
BRASS SEAT

Easier to make up—tighter when applied

Jefferson All Male Unions provide the means of making time and labor savings when installing pipe lines where a union is required between two female threaded parts. A typical installation for this type union is location between a check valve and a globe valve such as would be common practice on boiler feed lines. Another recommended application is between a valve and a threaded receptacle having female pipe threads.

On installations such as those noted, the use of a "Jefferson" All Male Union will effect a saving of two pipe joints and assure a better, tighter, more easily made up piping job.

All Jefferson Unions offer the exclusive Recessed Brass Seat which assures a drop-tight joint, unrestricted flow and protection from the threaded ends of screwed-in pipe ends. It will pay you to investigate immediately.

Your nearest distributor can supply your requirements or get in touch with us direct.

JEFFERSON UNION CO.

601 West 26th St., New York 1, N. Y.
LEXINGTON 73, MASS. LOCKPORT, N. Y.

SIMPLIFY COAL HANDLING
with
SAUERMAN
ONE-MAN SYSTEM
for
STORING AND RECLAIMING

Whatever your requirements in storing coal, you will find that your best and cheapest solution is to install a Sauerman Power Scraper System.

Requires only one man to operate. Builds a compact pile that is safe from the danger of spontaneous combustion. Reclaims as speedily as it stores.

There is a size and type of SAUERMAN System to meet your exact needs. First cost is small. Operation and maintenance costs extremely low.

Let us advise on your specific problem. Complete illustrated catalog free on request.

Above is a Sauerman Crescent scraper bucket stocking out coal. Notice that the bucket encloses its load and virtually floats across the pile. There is no churning of the coal; little dust. The bucket dumps automatically the instant it is pulled backward. In returning, it skims across the pile at a speed of 600 f.p.m.

SAUERMAN BROS., Inc.
562 So. Clinton St., Chicago 7, Illinois

aluminum, as well as *K & W* special alloy, electrodes are available, permitting repair on all metal casting.

K & W metal applicators are offered in *Super* and *Master* models. *Super* model is a heavy-duty applicator, capable of long, uninterrupted operation. *Master* model is for ordinary block repair shops where use at one time does not exceed an hr. **Dept P, Kerkling & Co, 1765 N San Fernando Rd, Burbank, Calif.**

Calking Compound

MIXTITE, AN ASPHALT POWDER MIX, is an easy-to-use waterproofing repair material. This fireproof material serves as a paint, plastic waterproof coating, calking compound, patching cement, adhesive or expansion joint compound. In its powder form, it is easy to work. It can be mixed to any consistency by simply adding any oil solvent (kerosene, turpentine substitute, etc). It keeps indefinitely and is not impaired by heat, cold or dampness. *Mixtite* black, available in 1- 5- and 50-lb. bags, is applicable for troweling or painting; *Mixtite* red and aluminum, for painting. *Mixtite* red is in 4½-lb bags, prepared to make 1 gal of paint consistency. *Mixtite* aluminum paint is in 3½-lb paper cartons. **Dept P, Rand-Williams Mfg Co, 377 Broadway, New York 13, N. Y.**

Spiral Return Idler

STYLE NO. 55RC rubber-covered spiral return idler is built of a flat-bar steel helical spiral, covered with rubber. This spiral is mounted on a standard assembly. Steel spiral is accurately machine-formed and permanently welded to bearing tube. Spiral itself is composed of right- and left-hand sections to insure belt centering. Thus, there is no tendency for belt to laterally drift to one side or the other.

Rubber used as the spiral covering is specially extruded and is simply opened up and snapped over bar. Natural tension of the rubber, increased by twisting in following the spiral, holds it in place. In addition, each end is securely clamped. Replacement of rubber, right on the job, is a simple matter. Each end of roll is equipped for high-pressure grease lubrication and is regularly furnished with hydraulic fitting.

This new idler is said to be a great retarder of ice forming on roll in freezing weather. Also, abrasive and corrosive action is reduced to a minimum. It is further claimed that, when sticky materials are hauled by the belt, there is no build-up on the spiral. **Dept P, Chain Belt Co, 1600 W Bruce St, Milwaukee 4, Wis.**

Electrode for Cast Iron

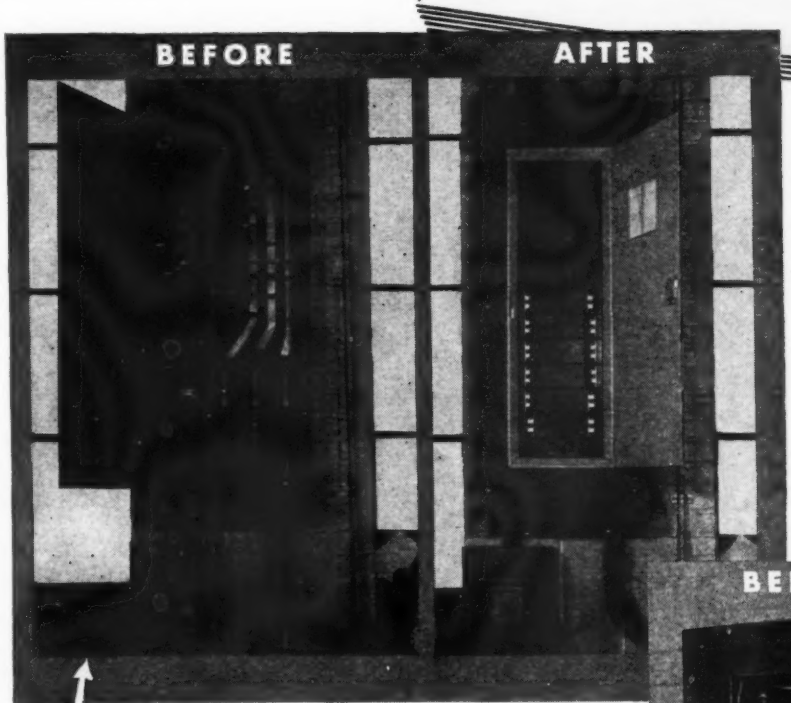
NI-ROD ELECTRODE is for all cast-iron welding. Its deposit is strong and machinable. Being nickel, it is actually much stronger than cast iron itself. *Ni-Rod's* arc is said to be stable in all positions. Deposit washes evenly up against sides of joint. *Ni-Rod* doesn't undercut or leave narrow grooves to trap flakes of slag that would weaken

HERE IS A

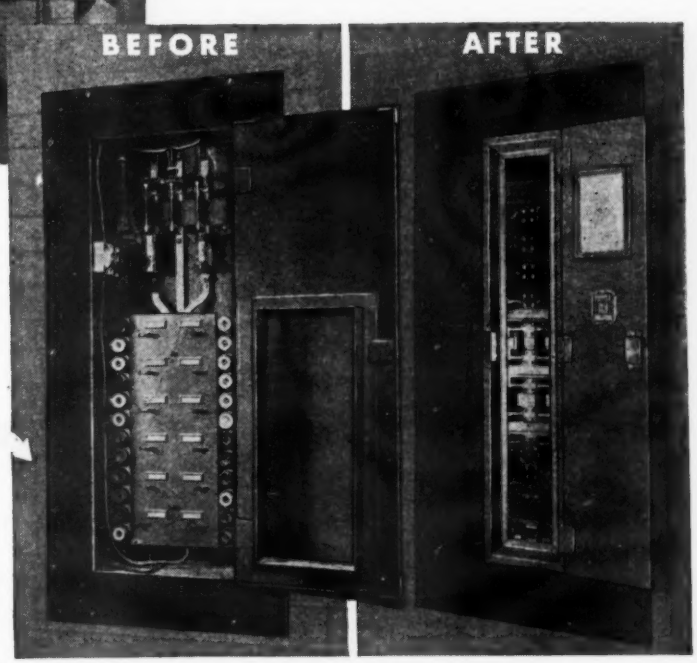
CONVERSION PLAN

THAT REALLY PAYS OUT

• *Here are two typical examples of conversions which involved a minimum of installation time and labor and brought the following results:*



1. *Increased panelboard capacities and added modern circuit breaker convenience and protection.*
2. *Utilized existing boxes and conduit.*
3. *Conserved power previously lost through overloads.*
4. *Eliminated the replacement of branch circuit switches and fuse clips due to excessive heating.*



300% MORE CAPACITY . . .

From three to twelve 3-pole circuits and provision for eight more whenever needed. Existing box was used and no conduits added.

138½% MORE CAPACITY . . .

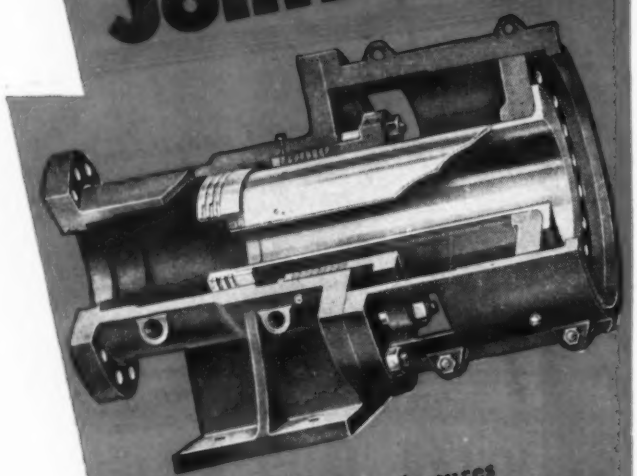
From 13 to 31 single and two-pole circuits. In addition, a needed 3-wire circuit was provided at bottom of panel. A speedy and economical changeover.

SQUARE D COMPANY

DETROIT • MILWAUKEE • LOS ANGELES

ADSCO

Expansion Joints



• ADSCO exclusive features have been proved and approved above ground and under ground in thousands of installations handling high-pressures and temperatures. ADSCO design provides for accurate, free movement of the slip. Alignment is maintained and binding on the packing is eliminated.

ADSCO Piston-Ring Type Expansion Joints illustrated above permit adding packing when joint is under full operating pressure without shutting down the system. Piston-rings at inner end of the slip hold back pressure during repacking. Write for Bulletin 35-15PR.

AMERICAN DISTRICT STEAM CO.
NORTH TONAWANDA, N.Y.
MAKERS OF UP-TO-DATE STEAM LINE EQUIPMENT FOR OVER 65 YEARS

ADSCO

Representatives in Following Cities

ALABAMA
Birmingham
CALIFORNIA
Los Angeles
San Francisco
COLORADO
Denver
Grand Junction
Pueblo
D. C.
Washington
GEORGIA
Atlanta
ILLINOIS
Chicago
INDIANA
Indianapolis
IOWA
Cedar Rapids
Des Moines
KENTUCKY
Louisville
LOUISIANA
New Orleans
MARYLAND
Baltimore
MASSACHUSETTS
Boston
Greenfield
MICHIGAN
Detroit
Kalamazoo
MINNESOTA
Duluth
St. Paul
MISSISSIPPI
Jackson
MISSOURI
Kansas City
St. Louis
NEBRASKA
Omaha
NEW YORK
New York
NORTH CAROLINA
Charlotte
NORTH DAKOTA
Fargo
NEW MEXICO
Albuquerque
OHIO
Cincinnati
Cleveland
Dayton
Middletown
OKLAHOMA
Tulsa
OREGON
Portland
PENNSYLVANIA
Philadelphia
Pittsburgh
SOUTH CAROLINA
Greenville
SOUTH DAKOTA
Sioux Falls
TENNESSEE
Knoxville
TEXAS
Dallas
El Paso
Houston
UTAH
Salt Lake City
WASHINGTON
Seattle
WISCONSIN
Milwaukee
WYOMING
Casper
CANADA
Ontario, Toronto
Quebec, Montreal
HAWAII
Honolulu

the weld as subsequent passes are made. This, in combination with chemical nature of flux itself, makes it easy to remove slag from a *Ni-Rod* bead. Its smooth-running arc and carefully controlled composition of nickel core and flux coating reduce need for special steps in preparation of the casting and treatment after welding.

Ni-Rod serves for general repair and maintenance of cast-iron parts and equipment, remedying minor flaws in new castings, and as a production tool. **Dept P, International Nickel Co, 67 Wall St, New York 5, N. Y.**

Pipe-Sealing Compound

BLACK MAGIC, a pipe-sealing material and gasket cement, handles such liquids as gasoline, oils, water, steam and a large variety of others, except those containing alcohol or made with an alcohol base. *Black Magic* is reported to form a permanent seal in pipe joints or gaskets, yet retains enough flexibility to permit expansion and contraction of metals without cracking. As this compound does not become brittle with age, it is particularly applicable to underground piping where strains eventually cause leakage when brittle compounds are used. This compound clings like glue to metal, and being completely insoluble in gasoline, it is successfully employed in oil pump and gas work, oil-burner installations, bulk storage and refinery piping or wherever petroleum oils are used or stored. It is sold in tube or case ready for application. **Dept P, Bowser, Inc, Fort Wayne, Ind.**

Welding-Gas Saver

DEVICE IS SAID TO CUT OXGEN and acetylene consumption. *Gasaver* has two important features not found in earlier models: First, it has a new nonsmoking pilot light; second, the lever rod, on which torch is hung between welds to shut off both gas and oxygen intake lines, is quickly adjustable as to length, so that any size or weight of torch will automatically operate closing valves. The *Gasaver*, regardless of weight of torch, eliminates danger of open flame. **Dept P, Weldit Inc, 648 Bagley Ave, Detroit 26, Mich.**

Pumping Unit

WITH INTEGRALLY MOUNTED reduction gear drive, heavy-duty pumping unit is designed on swinging vane principle, which makes it self-adjusting for wear. It has a capacity of 750 gpm at 150-psi discharge pressure and operates at 225 rpm. Internal construction is bronze fitted and units are furnished with anti-friction or sleeve bearings. Structural-steel base provides for pump and reduction-drive unit only. The prime mover, either engine or electric motor, is mounted separately.

Present plans call for production of units of similar design with speed variations from 150 to 400 rpm and capacities of 200, 300 and 400 gpm with pressures from 50 to 150 psi. Provision will be made for mounting prime mover on common base. **Dept P, Blackmer Pump Co, Grand Rapids, Mich.**

"But you claim to be the tailor in the family"

"Aw, please, Nelly, you can sew on buttons better than I can."

"Didn't you just tell me that there wasn't another pipe coverer in the whole Armstrong crew that could sew canvas as neat and fast as you could?"

"Yes, but sewing canvas on magnesia covering is a lot different from sewing buttons on coats."

"Didn't you say that a good pipe coverer should be able to sew like a tailor?"

"That's right. And a good pipe coverer has to be able to handle all kinds of tools. Take plastering the finish on a nest of fittings for example; it takes real skill———"

"All right, Jim, let me have your coat. I'll sew on the button."

Jim is right about the requirements for a good pipe coverer, but he didn't explain all of them. If you have ever watched the fitting of magnesia covering, the trowelling of cement finish, the neat cutting and sewing of the canvas, you would have become aware of the many skills that a pipe coverer must apply in his trade. That is why it pays to have trained and experienced workmen install industrial insulations. And in every one of Armstrong's offices you will find crews of mechanics who have the experience and ability to install every type of heat insulation or low-temperature insulation job. The next time you have insulation work to be done let a skilled Armstrong installation crew make certain that your job is done properly.

Free! New Insulation Chart

If you use insulation to control any temperature, high or low, you'll want a copy of a new chart recently developed by Armstrong. This check list shows which kind of insulation, and how much of it, can most profitably be used to hold any given temperature from 300° below zero to 2800° F. Write today for your free copy to the Armstrong Cork Co., Building Materials Division, 7009 Maple Avenue, Lancaster, Pa.

ARMSTRONG'S INDUSTRIAL INSULATION

Complete Contract Service For All Temperatures

From 300° Below Zero

To 2600° Fahrenheit

THE PACKING for EVERY PURPOSE

Stops Leaks Prevents Scoring

ALLPAX

This universal packing—consisting of long, tough fibrous asbestos fibres, thin flakes of anti-friction metal, minute graphite scales and a heat-proof lubricant — is recommended for general service against steam, water, air, ammonia, oils, gases, etc. where temperatures do not exceed 600°F. Fits all sizes and shapes of stuffing boxes. Special styles available for high temperature and corrosive liquids, for products, etc. Try it and you'll use it regularly.

Distributors everywhere

THE ALLPAX CO., INC., MAMARONECK, N. Y.

Hi-Test KEWANEE

FOR POWER and PROCESS STEAM

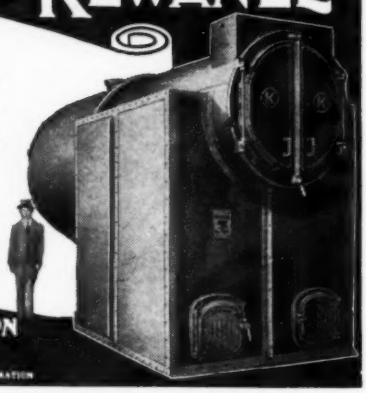
All-welded Portable with refractory lined firebox and fuel-conserving 2-pass tubes. A Q-u-i-c-k Steamer.

6 sizes. 50 to 150 H. P. 125 and 150 pounds W. P.

75 Years Boilermakers

WRITE DEPT. 89-K9 for 6' scale with pipe diameter markings.

WON FOR 5th TIME



KEWANEE BOILER CORPORATION

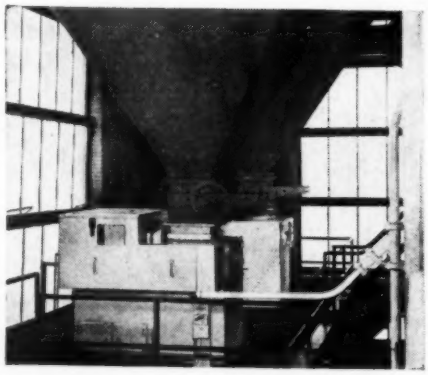
KEWANEE, ILLINOIS

A subsidiary of American Radiator & Standard Sanitary Corporation

CHECK { BOILER EFFICIENCIES WITH CONTINUOUS RECORDS

WEIGH all coal accurately on Richardson Automatic Coal Scales

Richardson Coal Scales installed for direct feeding to pulverizers. Scales weigh automatically, giving visual check to accuracy on every weigh.



Economy in boiler operation demands continuous, positive checks based on amount of coal used per boiler in relation to k.w.h. produced.

Richardson Automatic Coal Scales keep a constant check on weight of coal consumed by individual boilers; indicate uniformity of load carried by multiple pulverizers serving a single boiler. Instant readings can be taken any time on any unit, thus maintaining a continuous boiler test. Reports from leading plants show big economies with the Richardson Coal Weighing and Feeding System.

Don't guess at boiler efficiency. Check it right . . . by weight. Write for Bulletin No. 1143.

RICHARDSON SCALE COMPANY, Clifton, N. J.

ATLANTA • BOSTON • BUFFALO • CHICAGO • MINNEAPOLIS

WICHITA • NEW YORK • OMAHA • PHILADELPHIA • SAN FRANCISCO • DETROIT • PITTSBURGH

MONTREAL • TORONTO

Power News

(*Continued from page* 146)

Because of hazards present in the process, it is expected that more than usual use will be made of the "mock-up technique" in producing the atomic pilot plant. Exhaustive tests are scheduled at many stages of the development and on numerous of its aspects. Resulting data will be used in drawing up final specifications.

No indication may be had of the capacity of the pilot plant. It is expected that all equipment will be relatively conventional from the boiler on through the cycle. None of the major components has yet been ordered. Their production would require a year or more, under normal circumstances.

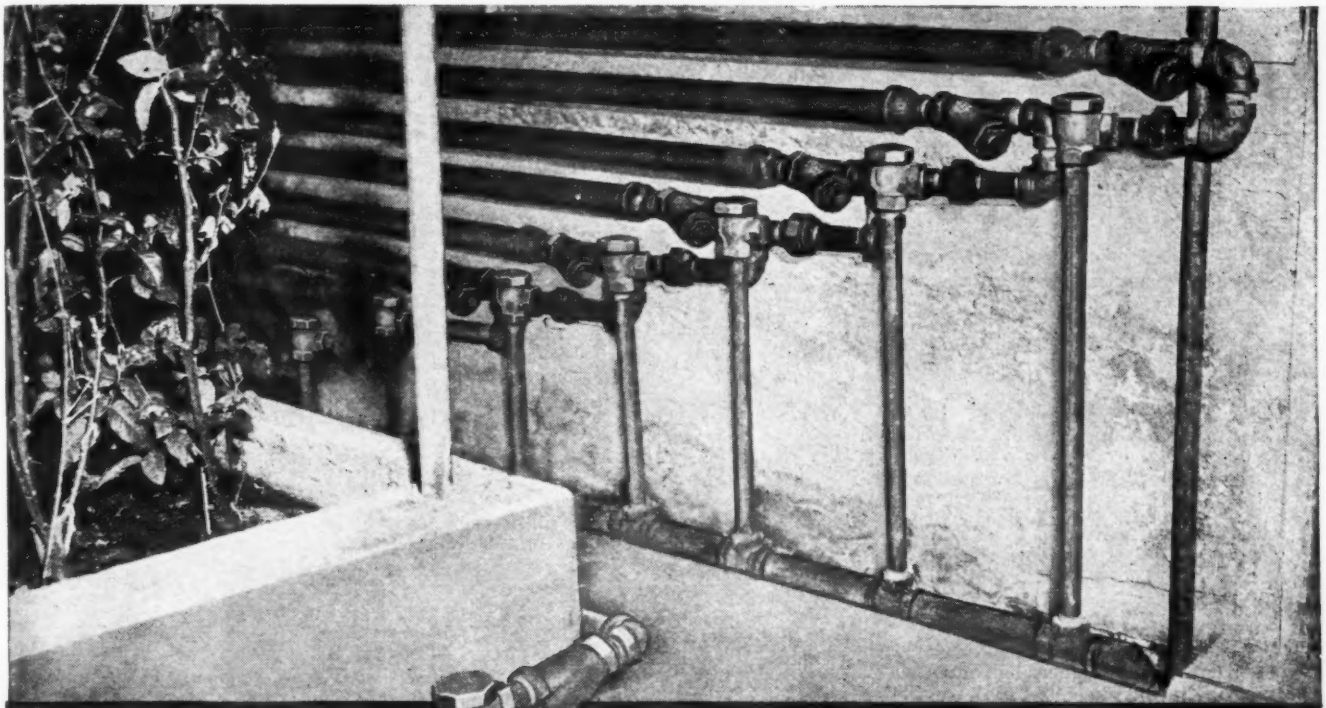
Included in the group designing the power pile are representatives of major electrical manufacturers, the Navy, and the Army Air Forces. The latter, with aircraft-engine companies, are supplying personnel and technical assistance. Engineering and physics departments of various universities and colleges are also expected to participate.

Westinghouse Announces Nuclear Physics Program

A broad program of research into nuclear physics and the problems associated with conversion of atomic energy into a useful power source for the peacetime world has been announced by scientists at Westinghouse research laboratories. Dr L W Chubb, director of the laboratories, said the program will be in direct charge of Dr W E Shoupp, manager of the electronics dept, whose research into pure science before the war culminated in the co-discovery of photo-fission—the splitting of uranium atoms by high-energy gamma rays with an accompanying release of large amounts of energy.

First step in the program is modernization of the 65-ft-high atom smasher at the E Pittsburgh laboratory. Workmen have already begun resurfacing the huge pear-shaped tank which incloses working apparatus. It will take about three months to get the equipment installed and ready to work. No basic changes are being made in the apparatus but advantage of improvements worked out in past few years will be taken to make it more efficient.

This is not a commercial research program, although it is entirely possible that whatever new knowledge is acquired may point the way to improvements in materials and processes that will affect daily life of much of the world. Essentially it is a continuation of fundamental studies on nuclear physics that private companies abandoned so scientists could spend their time, during the war years, on radar, atom bombs, etc.



SAVED . . . 30% of Fuel—

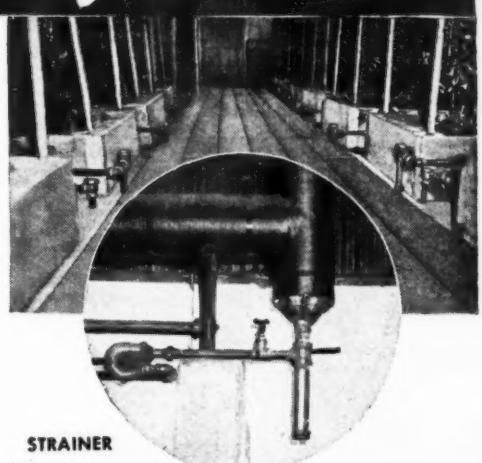
—60% ON MAKE-UP WATER

This large Long Island greenhouse was like many industrial plants. It grew like Topsy—and ended up with no over-all heating layout, unsatisfactory service and obvious inefficiencies.

Then, Sarco Engineers and the contractor laid out a modern system–with a Sarco Radiator Trap and Strainer on each of the long steam lines.

The savings in fuel are double-checked by the saving in make-up water. The value of reliable, even and continuous heat cannot be over-estimated.

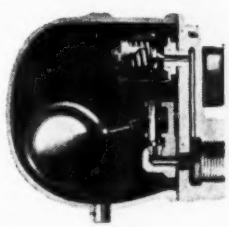
In thousands of apartments, commercial and industrial buildings the same inefficiencies exist. Your engineer can tell you what is wrong—the nearest Sarco representative can work out a combination of steam traps and temperature control which will place your operating services and costs on a par with the best there is. Ask for Catalog No. 100.



STRAINER

A radiator trap for each bay—and float traps on ends of mains.

RADIATOR TRAP

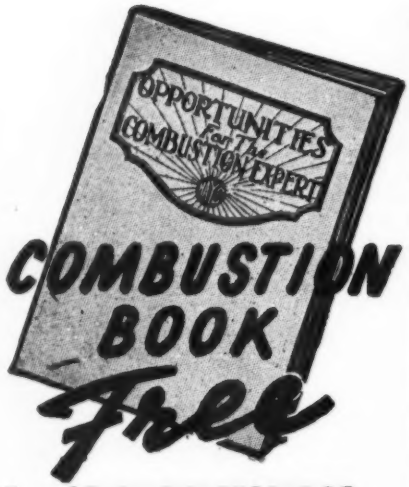


FLOAT-THERMOSTATIC TRAP

136

SARCO SAVES STEAM

SARCO COMPANY, INC.
Represented in Principal Cities
475 FIFTH AVE., NEW YORK 17, N. Y.
SARCO CANADA, LTD., TORONTO 1, ONTARIO



LEARN THE SECRET OF BIG EARNINGS IN

COMBUSTION ENGINEERING

There are plenty of big jobs today in Combustion Engineering. Such jobs have always been big pay jobs —and today they are better than ever. High fuel and equipment costs means a greater demand for combustion trained men than ever before.

Do you want such a job? You can have it—if you will train for it. And that is *easy to do.* Just a little of your spare time is required for the simple, easy-reading, practical Hays Home Study Course in Fuel and Combustion engineering.

A few of our friends whose employees have advanced through Hays training:

- International Harvester Co.
- Armour & Co.
- Combustion Engineering Co.
- Riley Stoker Corp.
- Iron Fireman Mfg. Co.
- Commonwealth Edison Co.
- State of Illinois Cities Service (Oil & Power)

and many others.

For 28 years we have specialized exclusively in such training. Today, Hays trained men are more in demand than ever. Now is the time to do what hundreds of others have done who hold substantial positions of responsibility today.

Write for Free Book Now!

Don't Delay! Mail Coupon Today!

You can't lose by getting the facts. We'll send our book, "Opportunities for the Combustion Expert" without obligation or expense to you. Learn how every lesson is administered by trained practical staff men who give the utmost in help and guidance. Get complete outline of course. Learn how to become a key man in Combustion. Send in the coupon now!

Hays Institute of Combustion

430 N. Michigan Ave., Chicago 11, Ill. Dept. 19

Our 28th Consecutive Year

HAYS INSTITUTE OF COMBUSTION
430 N. Michigan Ave., Chicago 11, Ill.
Dept. 19

Please send me your Free Book "Opportunities for the Combustion Expert"—No obligation.

Name.....

Address.....

City..... State.....

Company Name.....

Government May Retard Power Construction

Federal agencies have been directed to prepare their budgets for the fiscal year beginning next July 1 on the basis of standards which, if literally applied, could reduce substantially the Government's power-construction program. On instructions from President Truman, Acting Budget Director Paul Appleby laid down seven standards guiding the preparation of next year's budgets. They result from the President's direction that plans be laid not alone for a balanced Federal budget in fiscal year 1948 (July 1, 1947-June 30, 1948) but for accumulation of a "substantial surplus" for national-debt reduction.

Appleby dictated these standards for budget preparation: (1) Requirements for existing activities should be carefully reviewed to eliminate work of low priority and to provide for more efficient performance of necessary work. (2) Estimates should not comtemplate expansion in activities, either by increases in existing activities or initiation of new ones, unless such expansion is required to meet a demonstrable public need of the highest priority, cannot be deferred, and cannot be avoided by more efficient and economical administration. (3) Consideration will not be given to estimates for new activities for which no basis exists in legislation. (4) Estimates for authorized civilian public-construction and improvement programs should be limited to those for which the public need is so great, both from standpoint of economic return and social benefit, that it is not in the national interest to postpone them. All other projects, especially those that would impede flow of materials and manpower to the emergency-housing program, should be deferred until a later year. Consideration will be given to estimates for planning and investigations of authorized public-works projects for future initiation. (5) Construction for national defense purposes should be deferred in all cases where national security would not be impaired. (6) Necessary supplies and equipment should be acquired to the fullest extent possible from Government surpluses. (7) A specific instruction as to price assumptions that should be made will be issued after final Congressional action on the price-control act.

EFFECT OF APPLEBY PROGRAM

While the Appleby program is one that will have greater or lesser effects, depending upon degree to which it is enforced and willingness of Congressional groups to abide reductions in or delays to their pet programs, at least one immediate effect on the Government's electric-power program is foreseeable.

Interior Dept faces the necessity of obtaining enactment of a law authorizing the construction of steam-electric plants in conjunction with Federal hydro systems whose output it markets. Under point 3 of the Appleby standards, such authorization will have to be obtained before any estimates for such steam-electric capacity can be considered in Interior's fiscal 1948 appropriation bill. During debate on the 1947 Interior Appropriation Bill, all concerned agreed that, except for specific projects, no such authorization exists today.

STOP

HEAT LOSS by a

LOOK

at RANAREX*

LISTEN:

THERE'S no time lag with Ranarex, while precious heat goes up the stack. This *mechanical* CO_2 indicator and recorder gives you constant, instant readings -accurate to within 3/10 of 1%!

Users report Ranarex saves them as much as 20% on up-the-stack heat loss. You'll find big savings, too, with this rugged, dependable fuel-economizer.

NOW WRITE . . .

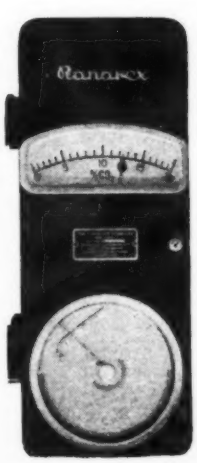
for free booklet. The Permutit Company, Dept. PR-9, 330 West 42nd Street, New York 18, N.Y.

*Trademark Reg. U. S. Pat. Off.

PERMUTIT'S

RANAREX

CUTS UP-THE-STACK HEAT LOSS



whatever your piping needs-

Shaw

fills them quickly-dependably

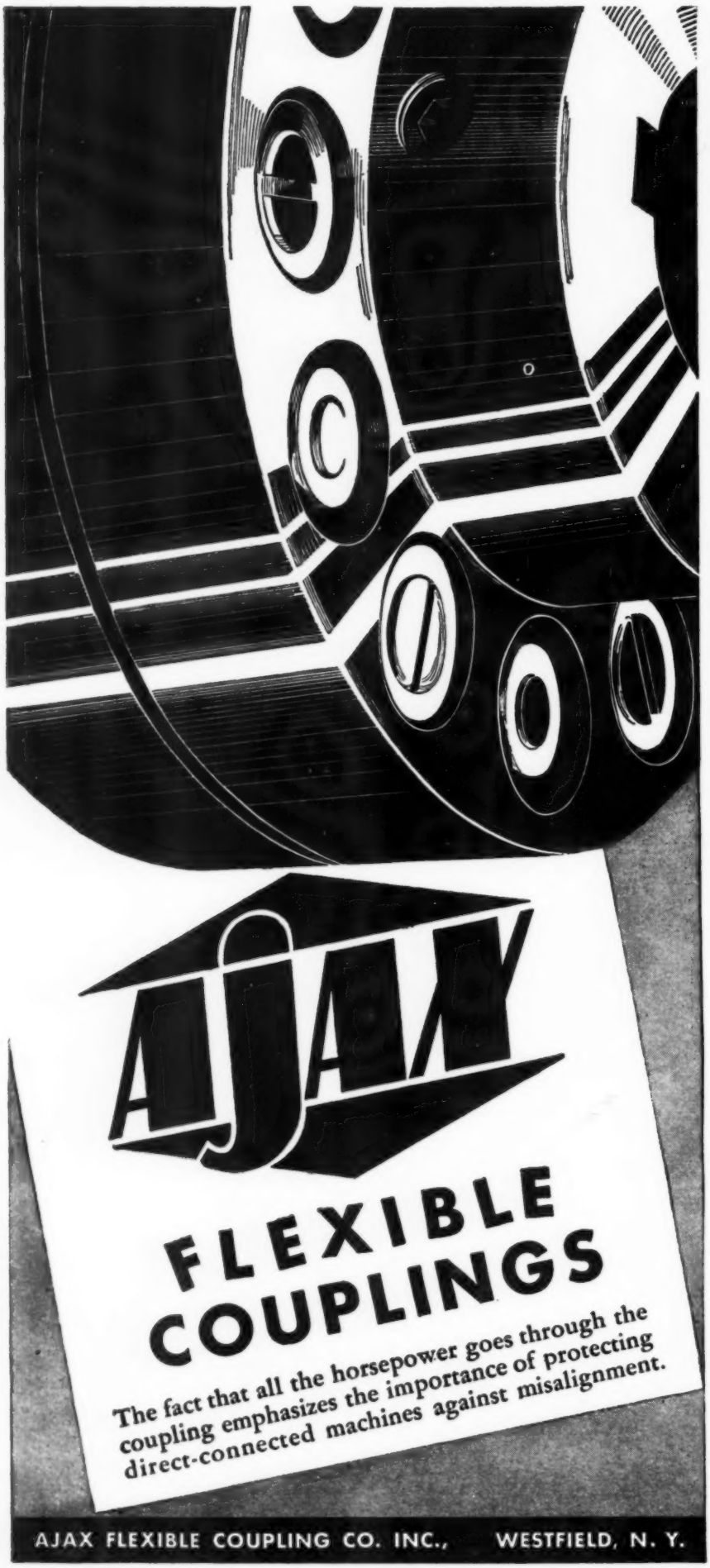
• HIGH-QUALITY—DEPENDABLE • PRE-FABRICATION & INSTALLATION

PIPING known since 1893

Benjamin F. Shaw Company is qualified to pre-fabricate and erect piping—any place in the United States and Canada.

Benj. F. Shaw III
President

BENJAMIN F. SHAW COMPANY—2ND & LOMBARD STS., WILMINGTON, DEL.


AJAX
FLEXIBLE
COUPLINGS
The fact that all the horsepower goes through the coupling emphasizes the importance of protecting direct-connected machines against misalignment.
AJAX FLEXIBLE COUPLING CO. INC., WESTFIELD, N. Y.

Finland Increases Electric Power Supply

HELSINKI, FINLAND (*McGraw-Hill World News*): Orders for electrical equipment and materials to the value of $7,600,000 already placed in Great Britain, the U. S., and at home, and an additional $4,000,000 yet to be spent, testify to the vigor with which Finland is attacking problem of rebuilding her power plants.

Finland was stripped by the terms of the 1944 armistice of one-fourth of her hydroelectric power, and her export manufacturing industries in Kymi Valley are held to only 50% of their productive capacity as a result of loss of Rouhiala plant alone. Accordingly, she is well aware how inescapably her recovery is tied to rebuilding her electric-power supply. In addition to these orders for generators, transformers and transmission equipment, which include one million-dollar order for an American 28,000-kva. turbine-generator and transformer, the Finns have started work during the past year on new hydroelectric plants to add about 900-million kwhr per year capacity, on top of plants under construction at the beginning of 1945 which will deliver some 1100-million kwhr per yr.

Orders for equipment include:

Imatran Voima Cy (Imatra Power Co) has purchased in Great Britain two generators, four transformers and couplings, at a total cost of $1,600,000, for its Pyhakoski hydroelectric plant, largest in Finland. The same company has under way also a 500-km (310-mi) transmission line from Oolu to southern Finland, and for this purpose has bought three transformers and couplings in Great Britain for $900,000.

Tainionkoski Cy, part of the State-owned Enso-Gutziet concern, has ordered from Britain three generators and three transformers, at a price of $1,400,000.

Pohjolan Voima Cy (Northern Power Co) is the buyer of the American turbine-generator, complete with transformer. This company, jointly owned by eight large Finnish industrial firms, was formed to rebuild power plants in northern Finland, which were destroyed by the Germans.

British Equipment

Various other plants have ordered nine additional transformers from Great Britain, for about $250,000.

English Electric, Metropolitan Vickers and Ferranti are the principal suppliers of the British equipment, which includes two 40,000-kva generators and two of 18,000-kva capacity; four 64,000-kva transformers, five of 40,000-kva, and one of 20,000-kva; and three couplings of 220-kw capacity and four of 110-kw.

Finland's electric power-generating capacity, at present about 1,000,000-kw, spread over some 600 plants, is divided about equally between hydroelectric and steam-generating plants. The magnitude of Finland's loss by the armistice terms can be better appreciated by a look at the figures: of 3,200,000,000-kwhr per year utilized output, the Finns had to surrender 850,000,000; of 1,850,000,000-kwhr per year under construction, 750,000,000 were taken from them, leaving 2,350,000-kwhr per year in operation and 1,100,000,000 in construction.

You Know They're in to Stay..

When You Install LADISH Controlled Quality FORGED STEEL FITTINGS

Yes, you know they're in to stay when you install Ladish *Forged Steel* Fittings. No more worry about premature failures and consequent crippling shutdowns . . . because Ladish *Forged Steel* Fittings are characterized by the extra strength and toughness that result from advanced *drop forging* procedures.

The rugged, reinforced design combines with a more compact grain structure and accurately controlled grain flow to produce a fitting that resists erosion, shock, strains and stresses common in piping systems.

Ladish Forged Steel Fittings are manufactured under painstaking metallurgical controls with full accurate threads (or deep welding sockets) precision machined for protection against leakage and for ease of installation. Ladish Fittings undergo a rigid inspection for dimensional tolerances, physical soundness and metallic composition. Thus each user of Ladish Fittings is assured consistent *Controlled Quality*.

For the security of economical, trouble-free piping installations—*install Ladish Forged Steel Fittings.*

Sold nationally through Authorized Distributors. Write for your copy of Ladish Forged Steel Fittings Catalog, Vol. II.

Controlled Quality

FITTINGS DIVISION

LADISH DROP FORGE CO.

CUDAHY • WISCONSIN (MILWAUKEE SUBURB)

District Offices: NEW YORK • BUFFALO • PITTSBURGH • CLEVELAND • CHICAGO • ST. LOUIS • HOUSTON • NEW ORLEANS • LOS ANGELES

TO MARK PROGRESS

Distinguished by corrosion-resisting Ladish green paint . . . permanent steel identity . . . size and pressure specifications.

INFILCO

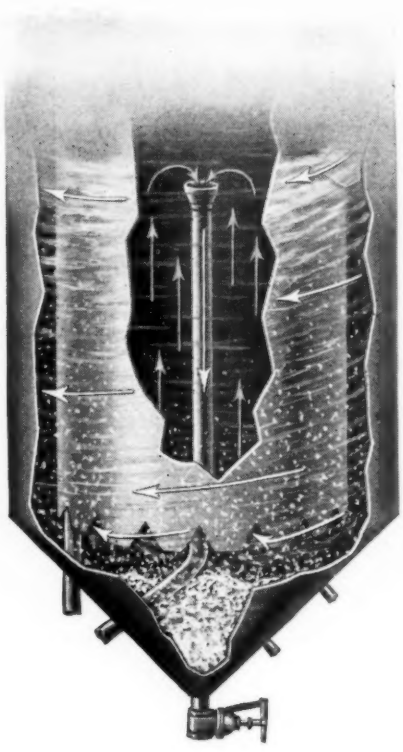
Better sedimentation produces Uniform Boiler feed water

One unit solved *three* worries at this plant . . .

Raw water at this southern refinery is the troublesome type. Not *properly* treated, it could cause hard, glassy scale, sludge and foaming. Reasons for this not-too-happy outlook are silica, hardness and high alkalinity. So in installing treating equipment, guesswork wouldn't do. These were questions for considered answers . . . from INFILCO engineers.

In this case, as in many others, proper treatment centered around *effective* reactions with selected chemicals in the sedimentation tank. Dissolved silica, hardness and alkalinity had to be reduced to harmless amounts. These objectives were established by careful analysis of the raw water, and here are the results.

Thorough mixing of heated raw water and chemicals begins in the mixing compartment of the INFILCO Sedimentation Tank. From this turbulent zone, the water flows in a quiet spiral that allows time for *complete* chemical reaction. Reaching the bottom of the tank, it flows upward, fully treated, to the settled water take-off. That sequence continues its day-in, day-out job of removing the trouble-causing elements from the water at this plant. It's one of the examples of reliable analysis and dependable performance that characterizes Hot-Flow installations the country-over. INFILCO INC., 325 West 25th Place, Chicago 16, Illinois.



It's the *internal* design that produces *better* chemical mixing, *better* solids separation and *better* sedimentation in the Hot-Flow Tank.

Unique in construction, the interior is divided into three sections. An upper section is the mixing zone. This is divided, by a stilling plate, from an outer annular compartment, which is equal in volume with a central cylindrical uptake.

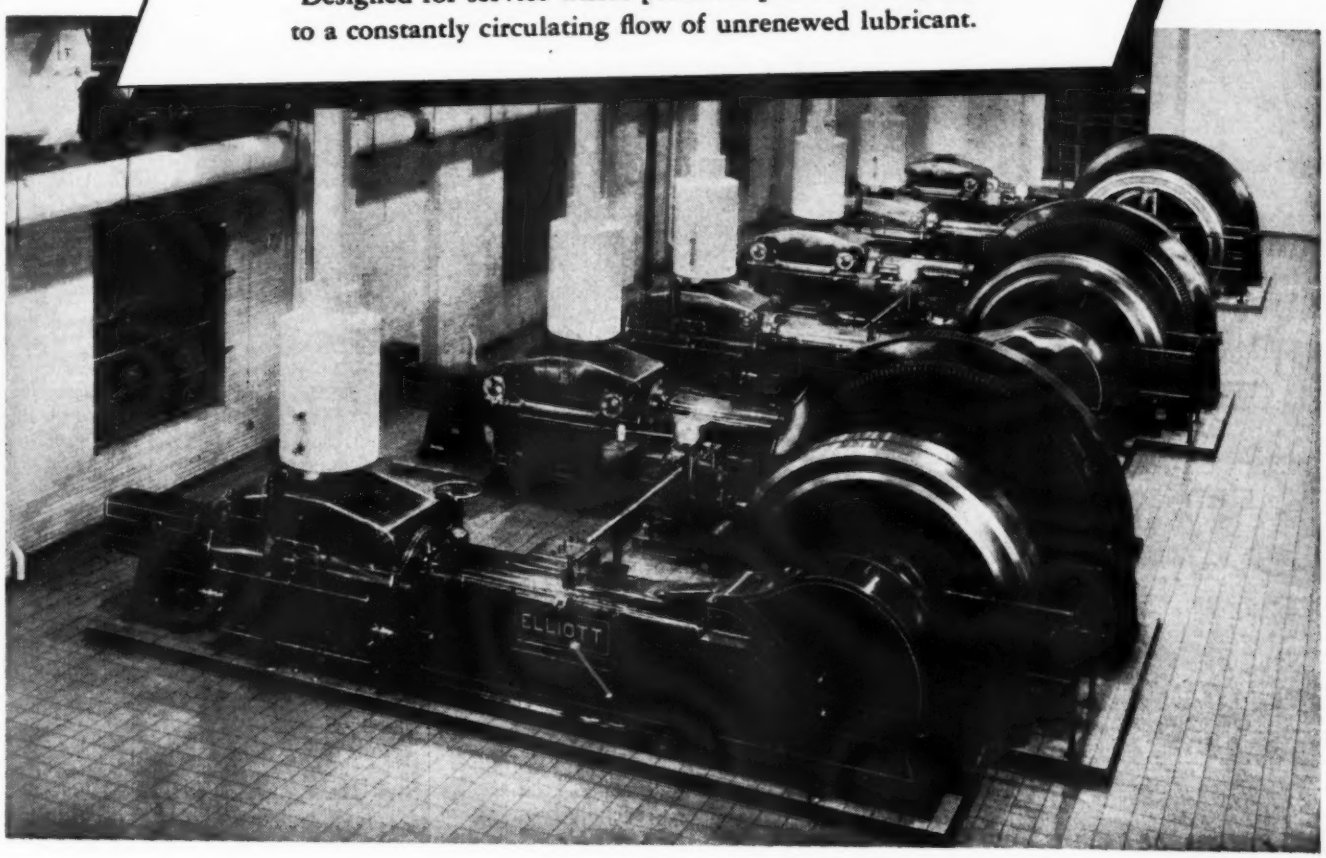
Thorough mixing of chemicals and thorough sedimentation in this tank always insure an adequate volume of properly treated feed water ahead of the filters.

CONSULT INFILCO — FIRST IN WATER AND TRADE WASTE TREATMENT

PRECISION REFINED FOR PRECISION EQUIPMENT

SINTURLITE

Designed for service where precision parts are subjected to a constantly circulating flow of unrenewed lubricant.



OXIDATION — always a possibility in lubricants which are constantly re-circulated through high speed mechanism — causes gum and sludge which limits oil life and contributes to inefficiency and equipment failure. The proper lubricant is made to withstand oxidation and resist possible breakdown.

SINTURLITE is precision refined to meet requirements of precision equipment. Extra quality is built in by modern refining methods and special care. Additives give further protection against oxidation.

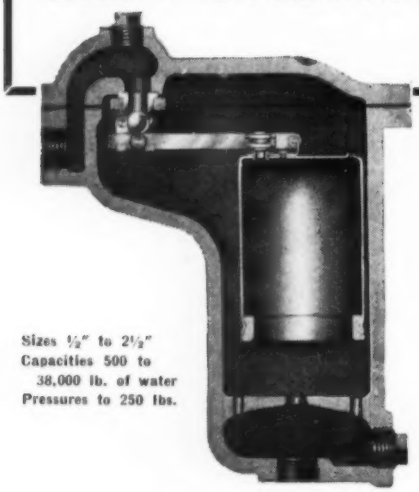
Non-corrosive and non-foaming, SINTURLITE separates readily from water. For long, uninterrupted service without deterioration, use *precision-refined* SINTURLITE.

SINCLAIR INDUSTRIAL OILS

FOR FULL INFORMATION OR LUBRICATION COUNSEL WRITE SINCLAIR REFINING COMPANY, 630 FIFTH AVE., NEW YORK 20

INSTALL CRYER TRAPS and FORESTALL

air binding
dribbling
slow venting
frequent cleaning



Sizes ½" to 2½"
Capacities 500 to 38,000 lb. of water
Pressures to 250 lbs.

Troubles so often associated with trap performance are absent insofar as Cryer Traps are concerned. This is not a mere claim on our part but a fact substantiated by the experience of Cryer users. For example:

". . . there has never been any sticking. ."
". . . they are self-cleaning. ."
". . . there have been no replacements (in three years). ."
". . . they need very little care. ."
". . . it really operates. ."

All of which means that Cryer Traps can be counted on to function economically, dependably and with trouble-free performance. And the reasons are obvious . . . they are non-binding, positive acting, quick venting, readily accessible and easily cleaned when necessary.

Performance is guaranteed . . . or your money is refunded. Ask for further details.

We carry all sizes of traps and repair parts for the line formerly known as the J-M Ball Steam Trap.

Manufacturers of Steam Specialties for over 40 years.

CRYER TRAP & VALVE CO., INC.
366 MADISON AVE. NEW YORK 17, N. Y.

WHITLOCK
HIGH PRESSURE STAGE HEATERS
for HIGH PRESSURE PLANTS

"Bleed" or extraction feedwater heaters, engineered for high pressure service, are a Whitlock specialty. The Whitlock Type R U-tube design and Type S straight tube—floating head designs are regularly being furnished for this class of service. The heaters are sturdily built and simply designed, incorporating the Whitlock mono-bloc head design which assures a minimum number of bolts and bolted joints. Our engineers are readily available to recommend the optimum design for the application to your specific operating problems.

Overall dimension — 63" O. D. x 221½" long.
Net Weight — 45,000 lbs.
Surface — 2,650 sq. ft.
Design Pressures — Shell 150 lbs., Tubes 900 lbs.

THE WHITLOCK MANUFACTURING COMPANY
46 South St., Elmwood, Hartford 1, Conn.
NEW YORK BOSTON CHICAGO PHILADELPHIA
DETROIT RICHMOND
In Canada: Darling Brothers, Ltd., Montreal
Authorized representatives in other principal cities.

ESTABLISHED 1891 — AHEAD OF THE TIMES FOR HALF A CENTURY

Soviet Plans to Build Large Hydro Power Plant

Ukrainian office of Soviet Hydroelectric Projecting Trust is now surveying site of a new large hydroelectric power plant to be built 7.5 miles north of Kremenchug, on Dnieper River. Station is projected to produce 1,500,000,000-kwhr annually for adjacent areas of Donbas and Krivoi Rog iron-ore field, as well as Kharkov and Kiev. It is to be linked with the Dnieper Hydroelectric Station system, increasing its power supply by nearly 1,000,000,000-kwhr.

Natural features of Kremenchug power site are ideal for construction of the dam and other installations. There is a natural ridge 7.5 miles long that will serve as one of the walls of the artificial lake to be dammed up. The reservoir itself will be more than 965 sq mi in area, and in volume will exceed that of the Dnieper Hydroelectric Station ten times. It will hold nearly 19,260 million cu yd of water, which will make the new power plant independent of all fluctuations of the river level.

Moreover, spring-flood accumulation of the Kremenchug reservoir will equalize Dnieper water flow at the Dnieper Hydroelectric Station located downstream and enable the latter to increase its wintertime capacity of 150,000-kw. Damming the river at the new point will deepen the navigation channel as far as Kiev.

Foundation bedrock for the Kremenchug dam, which is granite, juts up close to surface, offering excellent anchorage for the dam as well as enough local rock for entire construction job. Besides the dam, which is planned to create a fall of 56-59 ft, development will consist of powerhouse, 6-7 miles of earthern dike and a shipping canal with locks.

It is estimated 785,000 cu yd of rock will be blasted and removed, 6,540,000 cu yd of earth excavated, 1,046,400 cu yd of concrete and reinforced concrete laid, and nearly 26,160,000 cu yd of filling material hauled for the earthen dikes.

Leningrad Plant Builds High-Pressure Turbine

LENINGRAD, U.S.S.R. (*McGraw-Hill World News*): Stalin Metal Works in Leningrad has manufactured the first 100,000-kw superheated high-pressure high-temperature steam turbine ever to be produced in the Soviet Union. New unit operates at 1350 psi and 900 F, as compared with former designs operating at 450 psi and 750 F.

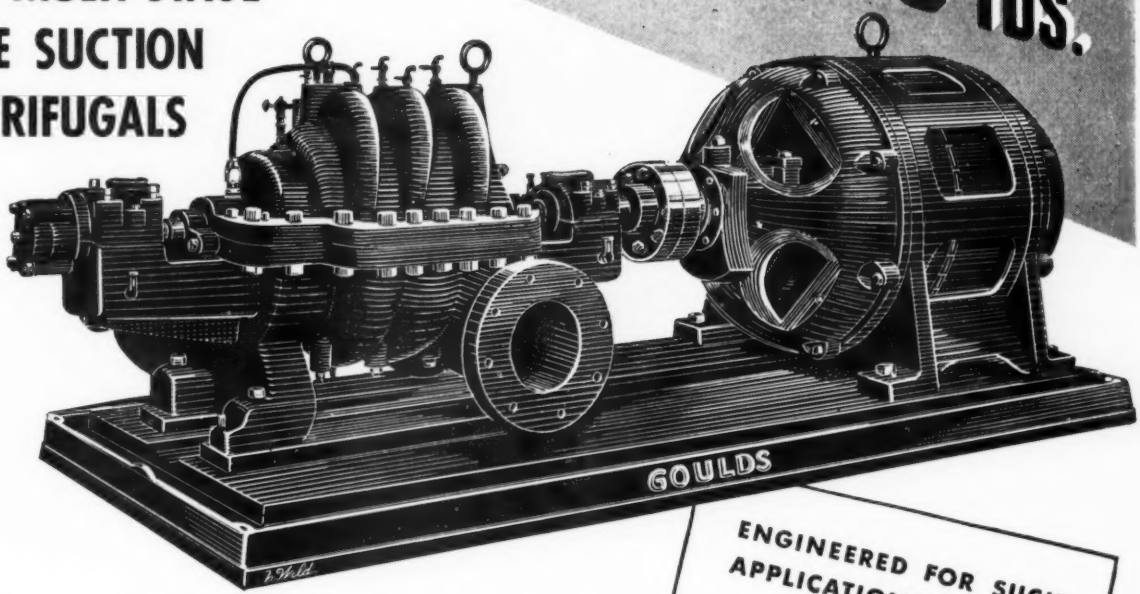
Unit weighs 265 tons and consists of 43,000 parts. Substitution of welded assemblies for castings in some sections of the turbine results in a saving of weight and simplicity of construction. Soviet power executives believe that it compares favorably with latest American units.

According to Russian engineers the turbine is a sample of a line of units that the Leningrad plant will produce. Similar units of 25,000- and 50,000-kw capacity, as well as high-pressure turbines for heat and power plants, are to go into regular production and supersede former types. Another 100,000-kw unit is to be built this year.

FOR PRESSURES UP TO 350 lbs.

Goulds

Fig. 3330 MULTI-STAGE SINGLE SUCTION CENTRIFUGALS



ENGINEERED FOR SUCH APPLICATIONS AS...

- General water service.
- Humidifier service in textile mills.
- Dewatering mines.
- Boiler feeding.

It's not uncommon for Goulds Multi-Stage Single Suction Centrifugal pumps to operate years without maintenance . . . not that the practice is advocated. But these pumps are popular with pump users because they are rugged. As it does with most pumps in the line, Goulds builds this series in sizes which enable you to select the one that meets your requirements most economically. Specifically, this means pumps of two to six stages and a capacity range of 100 to 1700 G. P. M. with heads up to 800 ft., depending on capacity.

THRUST BALANCE PERMANENT

An important thing to keep in mind about these pumps is thrust balance. To absorb any unbalanced thrust which might occur from clogged impellers or uneven or excessive wear at sealing surfaces, a double acting, double row ball thrust bearing is provided, securely locked in position. This operates in a continuous oil bath. It is one of the features contributing to low maintenance cost and the popularity of this pump.

ONE OF MANY TYPES

This is one of many types of centrifugals manufactured by Goulds. Whether you need single or double suction, single or multi-stage units, Goulds has the pump for the job. Write or call Pump Headquarters or your nearest Goulds Office.

Goulds PUMPS, INC.

SENECA FALLS, N.Y.

the PUMP FOR the JOB

Type DA-81 Pressure Control

MERCURY SWITCH
Hermetically sealed mercury switch is used. They cannot be affected by dust, dirt or corrosion; nor are they subject to open arcing, oxidation, pitting or sticking of contacts, all common causes of contact trouble. This switch will give better control service and longer control life.

BOURDON TUBE
(Hidden back of cover)
The Bourdon tube is the actuating element of the control. It is the oldest known, tried and proven element, having been used in gauges for many years.

OUTSIDE ADJUSTMENT
The outside double adjustment with the calibrated dial and pointers is a convenient feature, making it very easy to set the required operating range, plainly visible on the dial. All guesswork is eliminated.

GLASS FACE
The glass face on the cover permits seeing the entire operation of the control in plain view. One can always tell whether the switch circuit is open or closed, a great convenience whenever servicing becomes necessary.

Consult Mercoid on pressure, temperature, liquid level or automatic mechanical control problems.

THE MERCOID CORPORATION
4201 Belmont Avenue
Chicago 41, Illinois

THE ASSURANCE OF DEPENDABLE SERVICE BUILT IN EVERY MERCOID CONTROL

Atom Control Transferred To Civilian Commission

McMahon domestic atom-control bill, which President Truman signed recently, transferred the nation's vast atomic holdings—plants, know-how and weapons—from the Army to a 5-man civilian commission. Measure provides for an all-civilian commission with exclusive authority to own and operate plants capable of producing fissionable materials. The commission is authorized to (1) issue licenses, not to exceed one year at a time, for operation of plants (such as power plants) to use fissionable material, and (2) distribute, from its own production, fissionable material to operate such plants.

Transfer of atomic project from Army's Manhattan District to the new commission is not expected to result in any immediate shift in policy or activities in the atom field. Army's nuclear power-plant project, which has been contracted out to Monsanto Chemical Co and the major electrical-equipment producers for erection and operation at Oak Ridge, doubtless will continue.

Even before the McMahon control bill was signed, there was spreading speculation in Washington over who would compose initial membership of the commission. Most prominently mentioned was David Lilienthal, now head of Tennessee Valley Authority and chairman of the 5-man State Dept board that wrote the so-called Lilienthal Report on international control of the atom. One proposal, which has been discussed in Administration circles, contemplates appointment of Lilienthal board membership intact. Others who served with Lilienthal were Harry A Winne of General Electric, Charles A Thomas of Monsanto Chemcal Co, Chester I Barnard of Bell Telephone System, and J R Oppenheimer, physicist who headed the Los Alamos bomb plant of Manhattan District.

Federal Power Commission announces that Tennessee Gas & Transmission Co. Houston, Tex., has been authorized to construct and operate about 95 mi of 16-in. transmission pipeline extending from the San Salvador Field in Hidalgo County, Tex., to a point of connection with the company's main transmission pipeline in Nueces County, Tex., together with a dehydration plant in the San Salvador Field. Cost is estimated at $2,260,442.

Southern Natural Gas Co, Birmingham, Ala., has been authorized, the Federal Power Commission revealed recently, to (1) construct and operate about 80 mi of 16-in. natural-gas transmission pipeline extending from Pickens, Miss., to the Gwinville Gas Field located in Jefferson Davis and Simpson Counties, Miss. (2) install meters, pressure-regulating equipment and other facilities to tap the company's lines at points of connection with lines to be constructed by town of Ragland, Ala., city of Sylacauga, Ala., Alabama Gas Co, Alabama Natural Gas Corp, Birmingham Gas Co and Atlanta Gas Light Co, and (3) construct and operate about 7 mi of 6-in. line near Tallageda, Ala. Total cost of facilities is estimated at $2,608,200.

INCREASE THE CAPACITY
of Boilers and Tubes by Keeping All Heat Transfer Surfaces Clean

SAND-BANUM

Automatically Removes and Prevents Scale and Corrosion

"The Entirely Different Boiler and Engine Treatment"

Sand-Banum affords you a very definite and economical means of increasing the productive output of your fuel. It reduces fuel consumption, increases combustion efficiency and extends equipment life.

For closed or open cooling systems, where water is recirculated.

SAND-BANUM ★ BLUE SEAL EMULSION ★

Trade Mark

SAND-BANUM SPECIAL
is recommended for radiator cooler systems of every type of internal combustion engine.

The automatic operation of guaranteed Sand-Banum lessens time out for shut-downs and promotes maintained capacity operations.

Write today for details.

AMERICAN SAND-BANUM COMPANY, Inc.
9 Rockefeller Plaza, New York 20, N. Y.

Stock carried by
WESTERN SAND-BANUM COMPANY
Houston, Texas

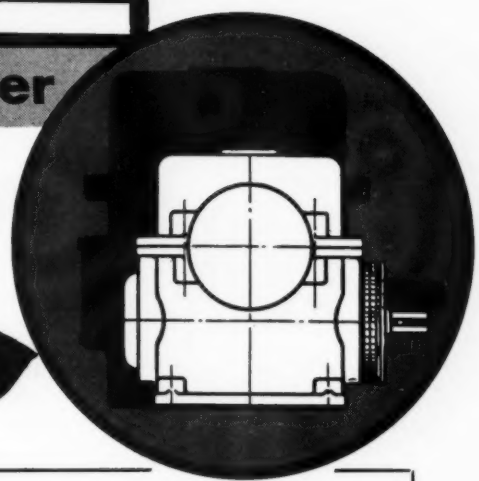
and at other convenient points including leading supply houses
Export Representatives
PETROLEUM MACHINERY CORP.
30 Rockefeller Plaza New York 20, N. Y.

Philadelphia

AIRKOOLED

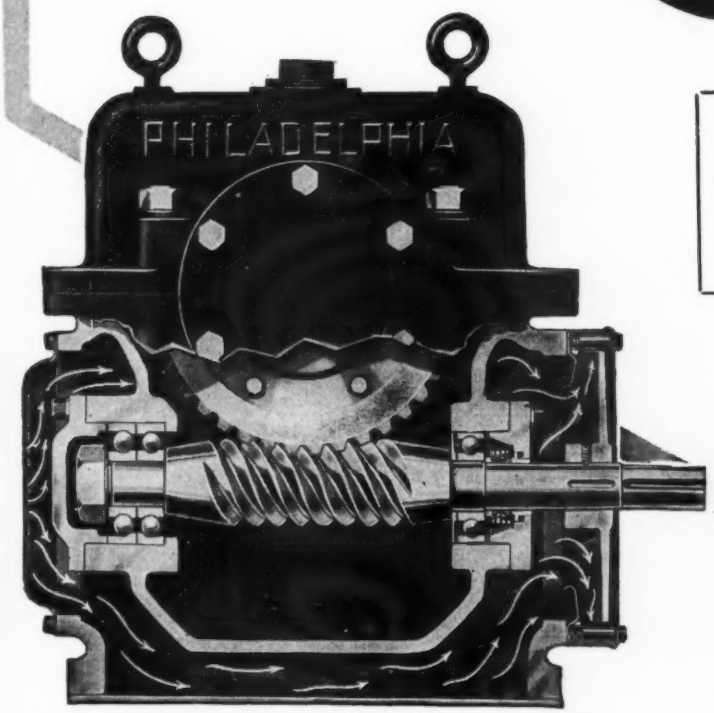
Worm Gear Speed Reducer

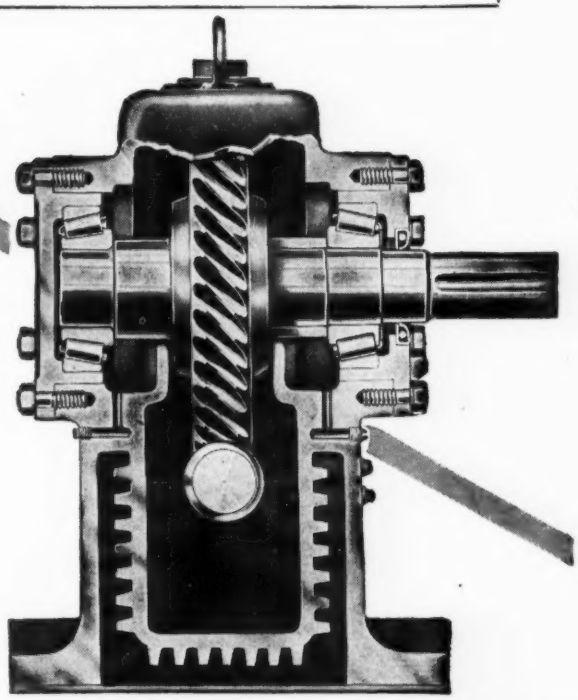
... gives you MORE LOAD CAPACITY in a Smaller Housing



Above is shown the comparative sizes of a size 675 Type AT standard unit and a size 475 AirKooled unit. Both deliver 20 HP at 1750 RPM. Ratio 4 6/7 to 1.

The cut-away drawings show the double-walled, finned housing and the flow of air around the oil reservoir.



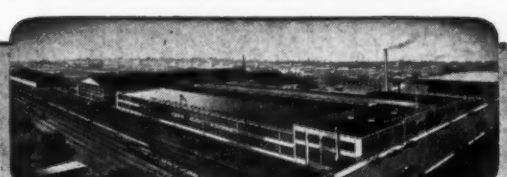


Considerable *space* and *weight* savings have been made possible by the design of Phila. AirKooled Worm Gear Reducers as compared with standard heavy duty type worm gear units.

The AirKooled design features a suction fan, mounted on the worm shaft, which draws air through the double-walled, finned housing. This dissipates generated heat, and there-by maintains a higher contact oil film strength and greatly increases the horsepower ratings at worm speeds of 580 and 1750 RPM. For all ratios at 1750 RPM the ratings are approximately doubled, so the AirKooled unit is about two sizes smaller than a standard unit of the same capacity.

Let us tell you what these savings can mean to you. Send for Bulletin 250 . . . on your Business Letterhead.

Philadelphia
GEAR WORKS INCORPORATED
ERIE AVE. AND G ST., PHILADELPHIA 34, PA.
NEW YORK • PITTSBURGH • CHICAGO . . . IN CANADA: WILLIAM AND J. G. GREEY LIMITED, TORONTO



Industrial Gears and Speed Reducers
LimiTorque Valve Controls

solved by Oakite

Descaling Mercury Arc Rectifier Cooling Systems

WHEN scale builds up excessively in the cooling system of your mercury arc rectifier, water flow is reduced, cooling retarded and the general operating efficiency of the equipment seriously impaired.

To avoid such trouble, your best bet is periodically to remove the deposits by circulating through coils, a recommended solution of inhibited acid scale dissolver Oakite Compound No. 32 as directed. Or, if pumping facilities are not available, fill the coils with solution and allow to soak for the prescribed period. Cooling efficiency is quickly restored to normal. Either procedure is simple, effective, surprisingly low in cost, and much safer than method using raw commercial acids.

FREE DATA ON REQUEST

Further details on this and 70 other essential maintenance cleaning jobs are contained in 20-page Oakite Digest. Write on letterhead for your FREE copy TODAY. There is no obligation.

OAKITE PRODUCTS, INC.
23 Thames Street, New York 6, N. Y.
Technical Service Representatives Located in All Principal Cities of the United States and Canada

OAKITE *Specialized* **CLEANING**
MATERIALS • METHODS • SERVICE

OPA Order Decontrols Capital Equipment Items

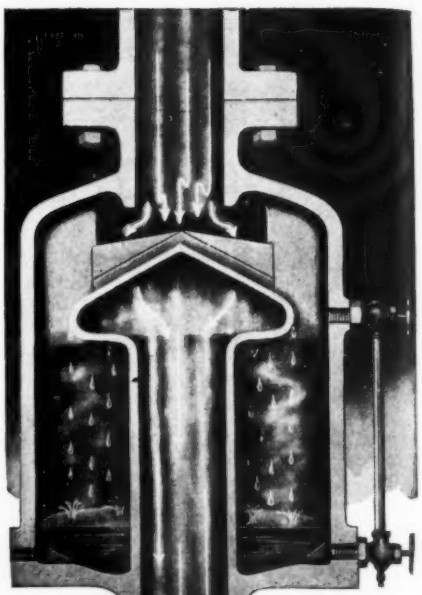
Office of Price Administration "celebrated" its return to legal status, with the President's acceptance of the compromise price-extension act, by issuing another order decontrolling $2,000,000,000 worth of capital equipment, including a number of electrical items.

The decontrol order is similar to that issued by OPA last April, which eliminated price ceilngs on turbines, large transformers, etc, and represents a continuation of the agency's program for decontrolling all items of capital equipment.

Items decontrolled by the latest action include ducts and accessories for electrical uses (with certain exceptions); electric meter-testing equipment; galvanometer and pyrometer movements; hangers and accessories, disconnecting and lowering, for lighting equipment; industrial-control equipment as defined in Section 4-IC of National Electrical Manufacturers Association Manual of Jan 31, 1946; electrically or magnetically actuated electrical instruments; instrument transformers; electrical panels; potheads; rectifiers of 1 kw and larger capacity; street-lighting equipment as defined in Section 2-SH of the *NEMA Manual*; traffic signals.

Purpose of decontrolling capital equipment, according to OPA, is to simplify its administrative task and to eliminate from price control items that generally are not promptly reflected in living cost.

Forty teachers of diesel engineering, from nearly as many colleges and universities in all parts of the country, recently completed the 2-week course for teachers of diesel engineering which was conducted at Pennsylvania State College. The course, which was sponsored by School of Engineering at Penn State, in cooperation with Diesel Engine Manufacturers Association, was the first of its kind in the country. It was designed to bring about a better understanding of function of engineering schools in preparing students to enter the diesel industry and to aid in improving standards of class instruction and laboratory work. In photo D A Fisher (holding data sheet), Tufts College, and J V D Eppes, Mass. Institute of Technology, record exhaust temperatures of a diesel engine.



CLEAN, DRY STEAM

With

COCHRANE
SINCE 1863

ALL-SERVICE SEPARATOR

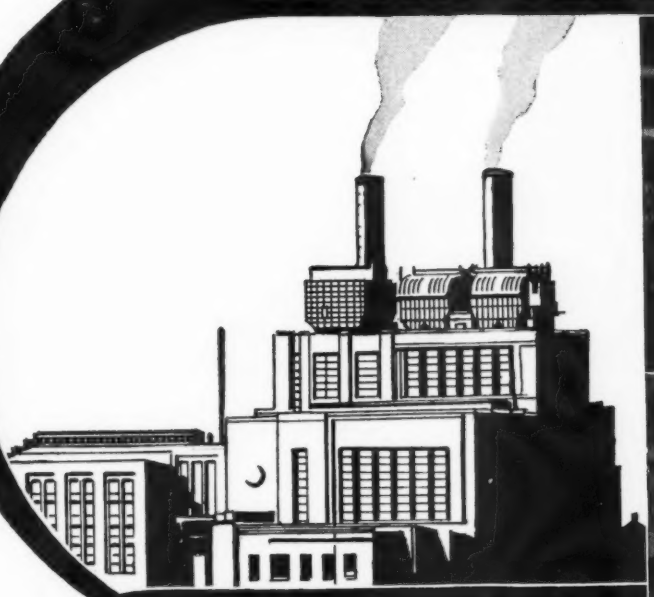
Where the flow of steam is vertically downward, the Cochrane Fig. 133 All-Service Separator is outstanding because of its practical design, low cost and high efficiency. Steam strikes the sloping ribbed baffle, collecting entrained moisture or oil particles, which are swept into the annular space or receiver chamber surrounding the discharge pipe. Entrainment won't mix again with the dry steam after separation has been effected. *Write for Publication 2950.*

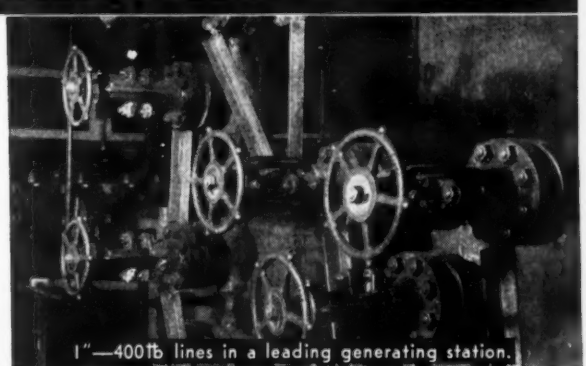
COCHRANE CORPORATION
3106 North 17th St., Phila. 32, Pa.

COCHRANE STEAM SPECIALTIES

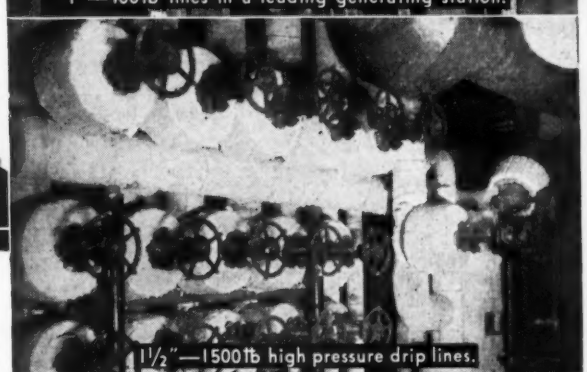
SPECIFY Vogt

DROP FORGED STEEL
VALVES, FITTINGS & FLANGES
FOR
STEAM GENERATING PLANTS

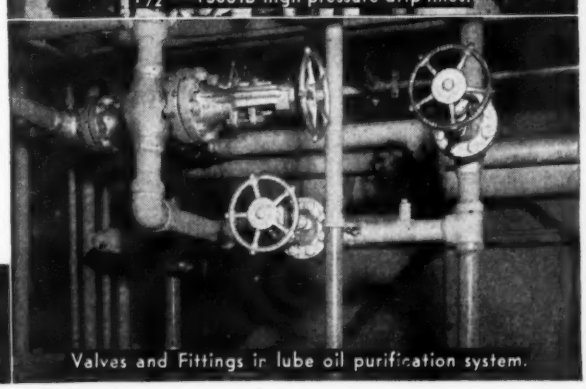




1"—400lb lines in a leading generating station.



1½"—1500lb high pressure drip lines.



Valves and Fittings in lube oil purification system.

SAFE and SURE control of vapors and liquids at high pressures and high temperatures in modern steam generating plants is dependent on piping materials having an inherent "plus" of strength and toughness. *Drop forged steel* Valves, Fittings, and Flanges made by Vogt play a vital part in the smooth, efficient operations of leading power plants.

Catalog F-8 is the drop forged steel Valves and Fittings Blue Book.

HENRY VOGT MACHINE CO., INC.
LOUISVILLE 10, KY.
Branch Offices: New York • Philadelphia • Cleveland • Chicago • Dallas

PRESSURE, TEMPERATURE, FLOW, ELECTRICAL AND LEVEL MEASURING INSTRUMENTS

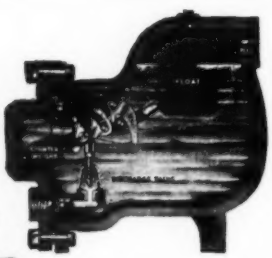
UNITED STATES GAUGE

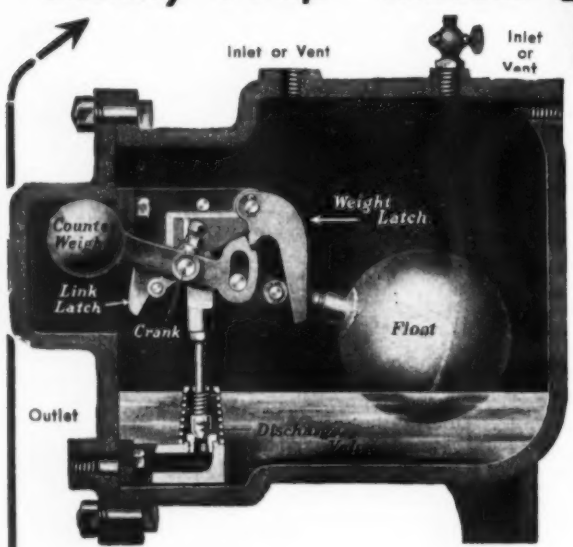
6 out of 10 manufacturers of original equipment specify U.S.G.

DIVISION OF AMERICAN MACHINE AND METALS, INC.

SELLERSVILLE, PENNSYLVANIA (15)

2 WAYS TO *Stop* "*Leaky-Trap*" TROUBLE





Here are two reasons why these two Nicholson weight-operated traps are such dependable solutions of the leaky-trap problem: first, a positive fluid seal is maintained over the discharge valve at low level; second, even in super-heated conditions the valve always remains leak-proof, due to its weight operation . . . Also piston-operated and thermostatic traps, for every power and process purpose.

Catalog 444 or

SEE OUR CATALOG IN SWEET'S

W. H. NICHOLSON & CO.

125 OREGON ST., WILKES-BARRE, PA.

Committee Studies Construction Problem

Civilian Production Administration has organized a committee to study relation of power-plant construction to emergency-housing program. The group was organized after leaders of the housing program attempted to restrict power-plant construction as unnecessary and in conflict with the housing program. One member is Paul B Valle, who handles utility affairs for CPA Administrator John D Small.

It was reported that representatives of Housing Expeditor Wilson Wyatt moved in on construction of powerhouses on basis that they are not needed and are depriving housing program of materials that could be used to better advantage in residential construction.

Because of Administrative provisions governing the processing of applications for construction priorities, very few if any applications for authorization to construct hydroelectric powerhouses are handled in Washington, whereas many applications for steam-electric plant construction are handled there. Thus, the matter so far concerns steam-electric powerhouse construction only.

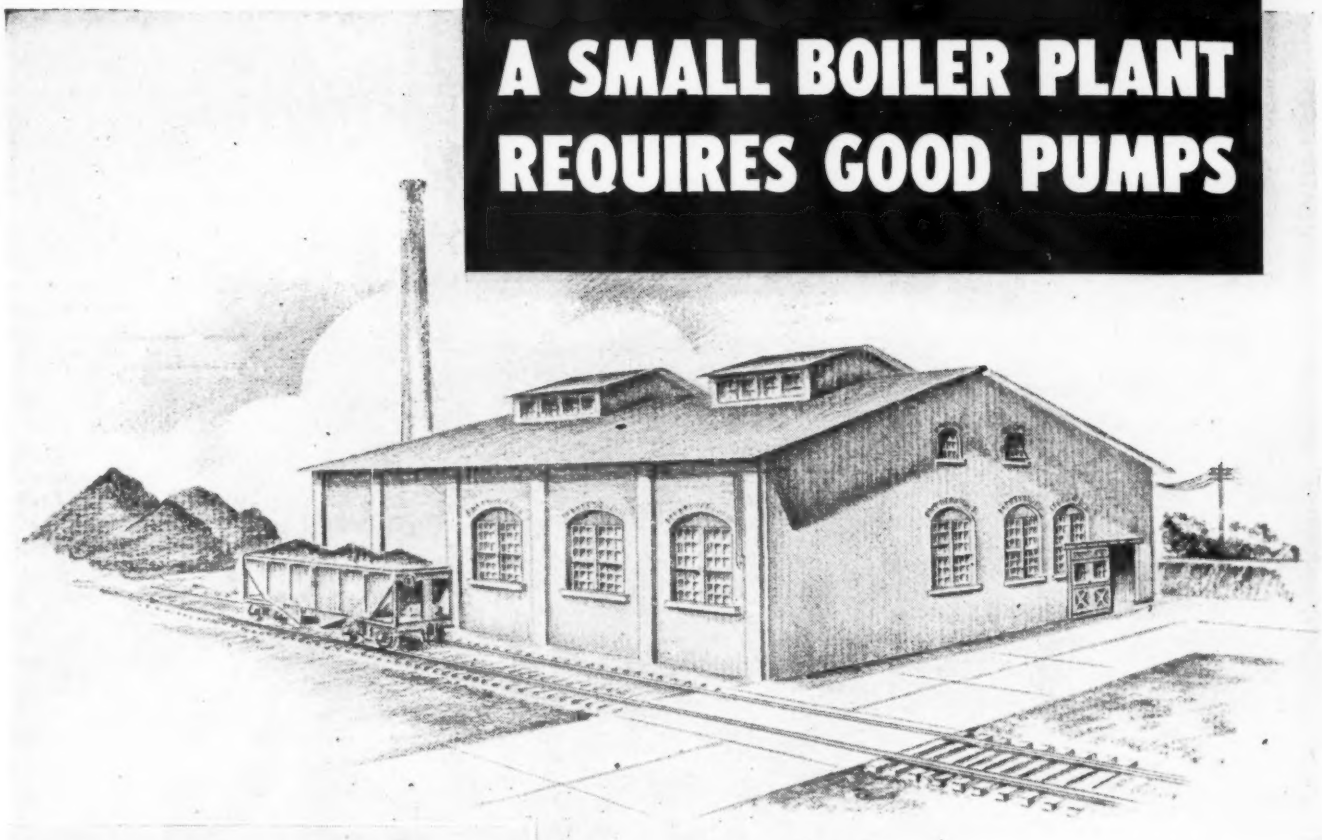
CPA's order governing construction allows an exemption of $15,000 for utility structures and no applicaton need be submitted for structures that cost less. Transmission lines and utility facilities that do not include buildings are not included. under the requirement that authorization be obtained from CPA before construction.

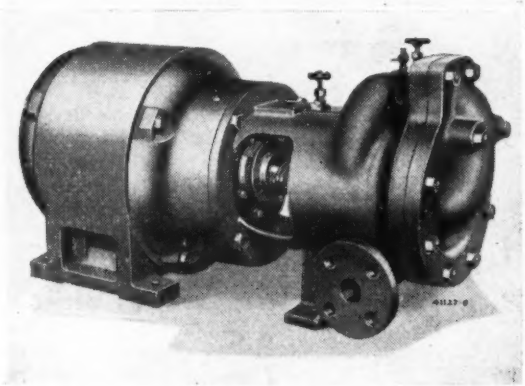
The attempt to defer or halt power-plant construction is not expected to result in any blanket order or policy against such construction. It was felt, however, that approval of such projects henceforth will be forthcoming only when substantial supporting data are produced to demonstrate the necessity for construction of the facilities applied for.

Ohmite Laboratory was dedicated recently in all-day ceremonies at the Armour Research Foundation, Illinois Institute of Technology, to serve industry of the Middle West with precision electrical measurements established on the basis of and approved by Bureau of Standards. Established through an endowment by David T Siegel, president of Ohmite Mfg Co and a 1926 graduate of Illinois Tech, the laboratory is equipped with $35,000 worth of testing and measuring apparatus that permits frequency calibration to 20 megacycles, measurement of the power factor and dielectric constant of liquid dielectrics to an accuracy of 0.01%, and audio and radio frequency measurements and calibrations. Although calibrations are not of the same fineness and preciseness as those of the Bureau of Standards, they have been perfected to fulfill most of industry's needs.

The laboratory, to operate on a nonprofit basis, will be directed by K W Miller, chairman of electrical engineering dept of Illinois Tech's research foundation. L W Marsch, supervisor of power and electrical measurements, will be chairman of the advisory committee.

A SMALL BOILER PLANT REQUIRES GOOD PUMPS





MRV 2-Stage Motorpump

Low operating costs and a minimum of maintenance are as important for tne feed pump in a small boiler plant as in a large one. That's why Ingersoll-Rand centrifugal boiler-feed pumps for small plants are built with the same care as the well-known I-R units for large, high-pressure stations.

There is an efficient, dependable pump in the line for your plant . . . Two-stage pumps, four stage pumps, (yes, even 30 stages if you need that many). There are pumps that will deliver as little as 5 gal. per min., others for any capacity you may require.

Careful selection of materials, balanced impellers, rigid pump shafts, deep stuffing boxes, and other big-pump features, assure long life and freedom from trouble.

Ask the Ingersoll-Rand engineer near you for literature on a pump to fit your plant. Some of those that might fit your needs are:

MRV: 2-stage Motorpump, pressures up to 200 lbs, capacities to 275 gal per min.

MRVH: 4-stage Motorpump, pressures to 260 lbs, capacities to 50 gal per min.

GT: 2-stages; pressures to 450 lbs, capacities to 2200 gal per min.

CNT: 4 to 8 stages; pressures to 800 lbs, capacities to 700 gal per min.

All sizes can be furnished with motor or turbine drive

IR SEVENTY-FIFTH ANNIVERSARY

COMPRESSORS • AIR TOOLS • ROCK DRILLS
TURBO BLOWERS • CONDENSERS
CENTRIFUGAL PUMPS • OIL AND GAS ENGINES

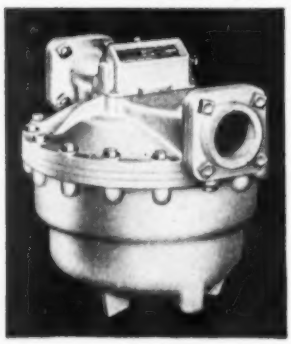
Ingersoll-Rand
CAMERON PUMP DIVISION
11 BROADWAY, NEW YORK 4, N. Y.

10-903

BOWSER
ESTABLISHED 1885

WHEREVER LIQUIDS ARE HANDLED.....

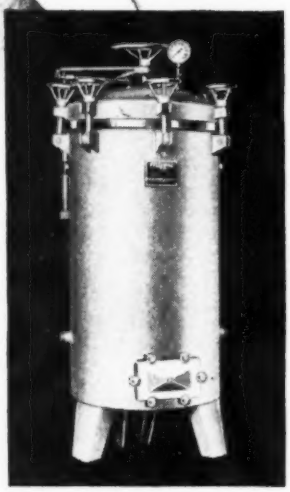
THERE'S A NEED FOR BOWSER EQUIPMENT
. . . for metering, filtering, distilling, pumping, fueling, lubricating, storing or dispensing.



BOWSER METERS.....

The Bowser Xacto . . . long known as "the world's most widely used meter" . . . is a positive displacement meter of extreme accuracy for recording of liquid transfer operations.

It is made in many standard types and for special applications. In accuracy Xacto Meters exceed all Federal and State requirements.



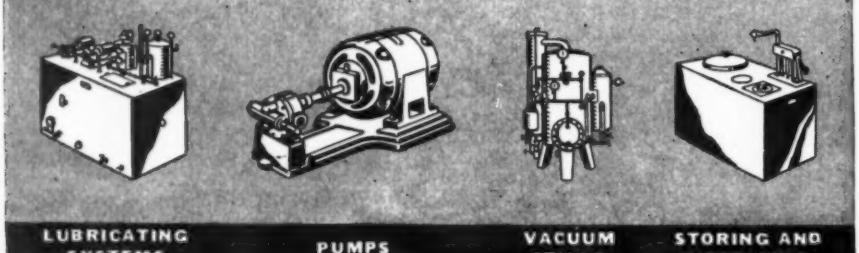
BOWSER FILTERS.....

The Bowser line of filters covers standard applications in a large group of industries. Monel screen, cloth, cellulose fiber or diatomaceous earth filters are furnished in a wide range of capacities for most liquids.

SALES and SERVICE

The Bowser Sales and Service System makes the Bowser man your next-door neighbor. Your present metering, filtering or other liquid handling problems will receive our prompt attention.
Write Bowser, Inc., 1335 Creighton Avenue, Fort Wayne 2, Indiana.

LIQUID CONTROL SPECIALISTS SINCE 1885



LUBRICATING SYSTEMS | PUMPS | VACUUM STILLS | STORING AND DISPENSING

APPOINTMENTS

Westinghouse Electric Corp appoints R F Wright Chattanooga manager, succeeding J G Simpson who retired after forty years with the company. C C Smith has been made special headquarters electronics sales representative in southeastern district, with offices in Atlanta. His territory will include all of N. and S. C., Ga., Fla., Ala., and portions of Tenn., Miss. and La.

Jordan K Silver becomes manager of New Haven, Conn., branch of **Westinghouse Electric Supply Co.** He succeeds Henry E Mitchell, who will continue as special representative. E W Gaughan has been appointed assistant general appliance manager in New York City.

Election of William E Knox as president and general manager of **Westinghouse Electric International Co** was announced. He succeeds John W White, who has resigned to become director general of Industria Electrica de Mexico. Westinghouse Electric Corp is a stockholder in Industria Electrica.

Bowser, Inc, appoints J B Trotman head of industrial pump div, with headquarters in Fort Wayne, Ind. E W Chapman has been made chief engineer of this new div.

R W Gillmore has been named manager of a new branch of **Allis-Chalmers Mfg Co,** at Claremount Hotel Bldg, Evansville, Ind. Warren J Holmes has been elected export representative in the Philippine Islands and will work with Earnshaw Docks and Honolulu Iron Works, distributors of heavy industrial equipment for firm's general machinery div. F A Fullerton has joined central station and marine sales and engineering dept of Allis-Chalmers, Milwaukee.

Arnold Pfau, consulting engineer of hydraulic dept of **Allis-Chalmers Mfg Co,** retired after 42 years with the concern. New appointments in hydraulic dept are following: (1) William J Rheingans has been named assistant manager. (2) Joseph J Ring has been appointed chief engineer of all engineering and development. (3) Frank E Jaski has been promoted from application engineer to hydraulic engineer in charge of hydraulic design, research and field test work. (4) J B Holt has been named assistant hydraulic engineer. (5) B R Nichols has been appointed assistant mechanical engineer in charge of governors.

Graver Tank & Mfg Co, E Chicago, Ind., announces appointment of Edward Welp as sales manager of water conditioning equipment. Harold C Conners and Harold R Fosnot have been named to head the firm's Chicago area sales activities.

W Stewart Clark retired as manager of manufacturing for **General Electric Co's** appliance and merchandise dept, Bridgeport 2, Conn. Carl M Lynge succeeded him in the position. Chemical dept is expanded further with formation of a metallurgy div, with headquarters in Pittsfield, Mass. The new div, representing the third

DISSOLVED OR ENTRAINED AIR

in circulating water—one of many factors governing condenser tube and heat exchanger tube performance—is presented in this discussion by Scovill engineers on selection of the proper tube alloy.

Fast-flowing rivers, rapidly changing tides, spray ponds and moving ships all create a condition causing entrainment of air. Furthermore, all raw water is saturated with dissolved air. Approximately 27 cu. ft. of air will dissolve in 1000 gal. of water — the quantity of air to saturate being dependent on the water pressure, composition and temperature. Any low-pressure areas in the circulating system permit the liberation of part of this dissolved air to ally itself with any free air in its erosive-corrosive attack on the tubes.

In actual operating conditions, where dissolved or entrained air in the circulating water is only one of the variables, tube life depends on the nature and/or extent of such other factors as: Velocity and turbulence of coolant . . . Chemical composition of circulating water . . . Temperatures inside and outside of tubes . . . Chemical or electro-chemical actions . . . Marine growths or other deposits . . . Sewage and wastes present . . . Development of protective film . . . Media surrounding tubes.

One of the principal objects of Condenser Tube Technical Research has been the development of alloys designed to give the user longest tube life and most trouble-free service. Where the major factor affecting tube life is the presence of dissolved or entrained air, satisfactory alloys include Cupro-Nickel, Aluminum Brass and Phosphorized Admiralty, each within its temperature limitations.

So many variables surround any condenser or heat exchanger tube application that each case must be treated as an individual problem.

Data accumulated during Scovill's continuous study of condenser and heat exchanger tube service conditions for every known application equip its Technical Service Department to offer sound guidance in tube alloy selection for existing or proposed installations.

THREE SCOVILL SERVICES

Scovill's *Service in Men* offers experienced engineering to help solve your tube selection and installation problems. *Service in Metals* develops and produces Scovill tube alloys that conform to your requirements. *Service in Manuals* consists of literature which gives you latest, authentic information on condenser and heat exchanger tubes. For a free copy of Condenser Tube Booklet, address Scovill Manufacturing Co., 13 Mill St., Waterbury 91, Conn. *Export Dept.* 405 Lexington Ave., New York 17, N. Y.

SCOVILL

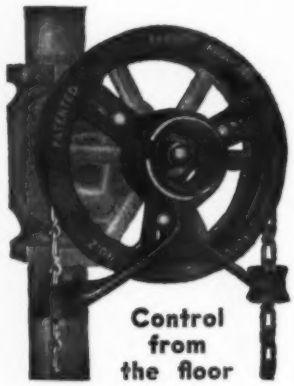
SCOVILL

CONDENSER TUBES

One Product • Three Services

Service in Manuals • Service in Metals • Service in Men

Make Your Overhead Valves SAFE and Easy to Reach---



With the Babbitt Rim for Valves you eliminate danger and banish the step ladder. You can now place your valves wherever they come economically and conveniently. They fit any valve. Let us tell you more about them. Write today.

BABBITT STEAM SPECIALTY CO.
New Bedford, Mass.

HERCULES
SEAMLESS COPPER
FLOATS

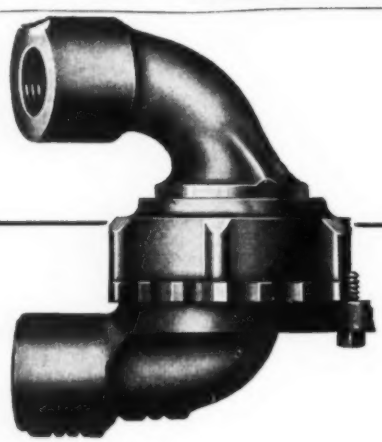
GUARANTEED
TO STAND UP!

Every Hercules Float carries our guarantee to stand up under 350 lbs. working pressure and 500 degrees temperature.

Fabricated of seamless copper under our special spinning process. Hercules Floats are uniform in thickness and high in mechanical strength.

You can depend on Hercules for floats—in standard shapes up to 10 in. and in special types to your specifications—to give long, dependable, economical service. Insure carefree maintenance of water level in your heaters, tanks, reservoirs and other equipment by specifying "HERCULES."

HERCULES FLOAT WORKS
200 Franklin St.
SPRINGFIELD, MASS.



FLEXO JOINTS
—make pipe flexible

FLEXO JOINTS make pipe flexible with the safety of rigid fittings. They will swivel through 360°, yet there is no restriction of the flow of fluid. There is full pipe area at any angle.

FLEXO JOINTS may be used for conveying steam, compressed air, water, oil, gas, and other fluids under high or low pressure. Smooth working—no chattering or binding. Use them to make up movable pipe lines or to supply machinery or equipment with any fluid while in motion.

Write for bulletin No. 166 and details about their use in your service.

FLEXO SUPPLY COMPANY Inc., 4224 OLIVE ST. St. Louis (18).
In Canada: S. A. ARMSTRONG 115 Dupont St., Toronto (5), Ontario

operating unit incorporated in this dept. will handle sale of permanent magnets and metallurgical products. Dr Royal K Abbott left for Rio de Janeiro, Brazil, where he will be laboratory director for General Electric, S. A.

Reorganization and expansion of **General Electric** apparatus dept's special products div, calling for establishment of four separate sections and a marketing and promotion group, has been announced. A laboratory products section will pioneer sale of apparatus developed by the company's laboratories. Other sections created are: a power rectifier section, responsible for electronic equipment to deliver dc power for electrolytic processes, mines and railways; a process instrumentation section, responsible for sale of equipment for measurement and control of a process; and an educational section, responsible for sale of all apparatus dept products to educational institutions. A special group has been created for promotional activities of special products div. Sale of permanent magnets has been transferred to chemical dept. New section heads appointed are Harrison Johnston IV, laboratory products section; S Martin Jr, power rectifier section; C W Bowman, power rectifier section; and D Lee Chesnut, educational section. C W Merritt was named to take charge of promotional activities group.

Star Electric Motor Co terminated its reorganization proceedings and named following officers and executives: Elvin E Hallander, president and general manager; Franklin R Carmines, vice-president and factory manager; Donald C Lillis, treasurer; Howard W Horne, assistant treasurer; Harold Sokobin, secretary; James M Adair, sales manager; Eugene A Bacquet, assistant sales manager; and James C Carney, purchasing agent.

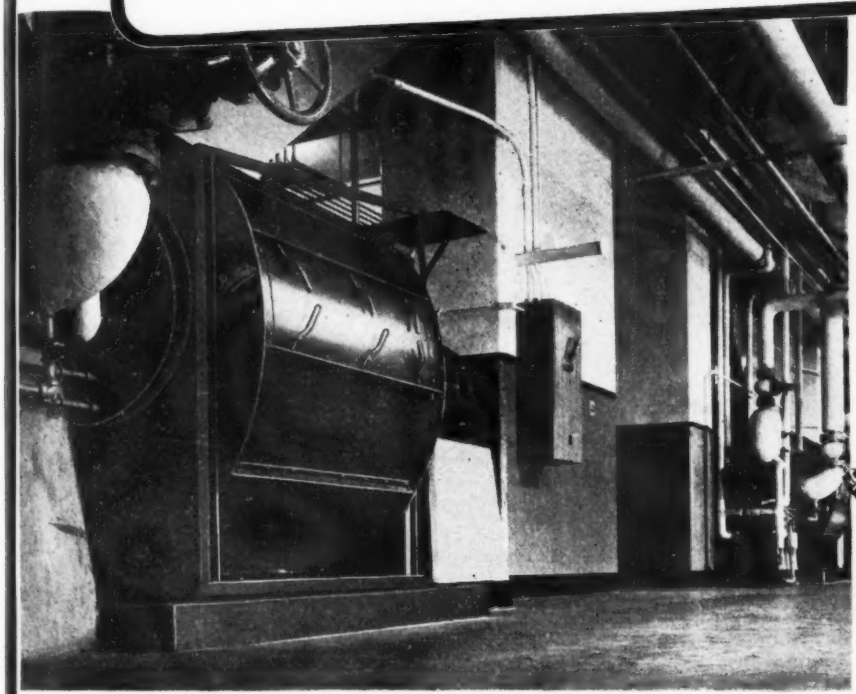
R W Mason Jr joined development and research div of **International Nickel Co.** He will make his headquarters at Detroit technical section of the div. Mr Mason will serve in Detroit office as metallurgist and consultant on nickel in ferrous and non-ferrous castings.

Combustion Engineering Co opened a Mexican subsidiary, named Combustion Engineering de Mexico S. A., with offices at 1, Calle Lopez, Mexico City. George C Siefert is manager of the new branch. Seldon Merrill is head of boiler installation and maintenance dept. Boilers and installations will continue to be imported from the corporation's factories in U. S., but the Mexican affiliate will maintain a permanent staff of technical personnel.

Wagner Electric Corp announces appointment of F F Simon as vice-president and controller, G A Waters as vice-president in charge of manufacturing and K M Coggeshall as assistant vice-president in charge of production and purchasing.

J E Murphy has been named manager of distributor sales and D A Cameron as assistant general sales manager of **Parker Appliance Co,** Cleveland. Harvey E Schroeder has been appointed manager of

"Cutting Power Costs Where Power Starts – In The Boiler Room!"



"Buffalo" DRAFT FANS

Getting at the root of power-producing costs means *increasing your boiler efficiency!* And hundreds of plant managers have found that "Buffalo" Mechanical Draft Fans can do this very thing.

These rugged Forced and Induced Draft Fans are built to take the battering work of boiler draft for years without costly time-outs for maintenance. Plates and blades are extra-heavy gauge, hot-riveted for greater strength . . . and housings exceptionally rugged. When finally it's time for replacements, all parts are readily accessible and easily removed.

Add to these maintenance savings fan engineering that delivers more air per power dollar, and you have a picture of the savings these fans can give your system. "Buffalo" representatives, in all principal cities, will gladly advise you as to the *right* fan. Call one in . . . for increased boiler efficiency!

HELPFUL FACTS! You'll find complete, descriptive data on these cost-cutting fans in Buffalo Bulletins. Send for your now!

Offering You

- **LOWER MAINTENANCE**
- **HIGHER DELIVERY**
- **LONGER SERVICE**
- **ACCESSIBILITY OF PARTS**
- **ECONOMY IN POWER CONSUMPTION**

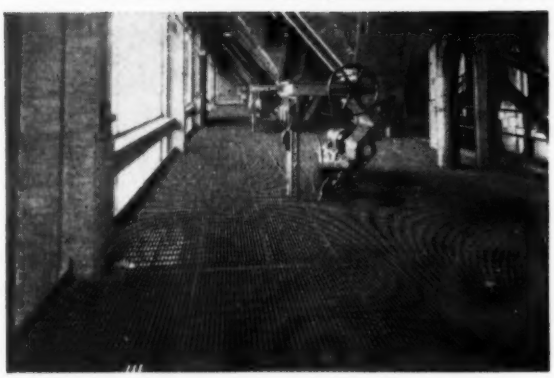
BUFFALO FORGE COMPANY
488 BROADWAY **BUFFALO, NEW YORK**

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

"Buffalo"

MECHANICAL DRAFT FANS

Install safe, economical
MACWHYTE
ELEVATOR ROPES
Order through your Distributor or
Elevator Maintenance Man
6 x 19 Macwhyte Traction Steel, PREformed or Non-PREformed
If you want elevator ropes with a minimum of stretch, yet ample flexibility to withstand bending fatigue, specify Macwhyte. Made of tough, long-life wire drawn from selected steels in our own mill. Strict metallurgical control gives uniform high quality and long service.
Your Elevator Maintenance Man can get low-cost-per-car-mile Macwhyte Elevator Ropes from Macwhyte Distributors and Mill Depots.
PREformed and Non-PREformed elevator ropes
8 x 19 Macwhyte Special Traction Steel, PREformed or Non-PREformed
MACWHYTE COMPANY
2944 Fourteenth Avenue, Kenosha, Wisconsin
Makers of the correct ropes for your equipment
MACWHYTE COMPANY 50th Year 1896 - 1946
NO. 871-E



FOR SAFETY
STRENGTH
DURABILITY

USE MITCO
OPEN STEEL
FLOORING

The square-edge, uniformly spaced metal bars provide a non-slipping surface; the rectangular spacings and 90% open area permit maximum lighting and ventilation.

■ Of pressure formed construction, there are no welds to weaken, no rivets to loosen, no bolts to rust—no dirt-catching nor light-obstructing projections.

■ Every Mitco panel is a strong, integral unit, capable of supporting heavy loads without lateral deflection.

■ *Send details of area to be covered, giving size, type and location of supports, and Hendrick will submit Mitco recommendations—without obligation. Write for complete information.*

ARMY E NAVY

HENDRICK
Manufacturing Company
46 DUNDAFF STREET, CARBONDALE, PENNA.
Sales Offices In Principal Cities

Perforated Metals
Perforated Metal Screens
Architectural Grilles
Mitco Open Steel Flooring,
"Shur-Site" Treads and
Amorgrids.

newly created Pacific div. He succeeds Paul Locklin who has resigned as manager of Los Angeles manufacturing div which, with the company's Pacific sales district, is being combined into a single West Coast organization.

E I Pollard has been made manager of **Elliott Co's** Ridgway div. He is in charge of electrical engineering for the company, replacing Quintin Graham who became assistant manager of Ridgway div.

De Laval Separator Co announces opening of two new offices—one in Minneapolis and other in Kansas City. Both will be under jurisdiction of Chicago headquarters. Kansas City office will be in charge of P W Perry and Minnesota office will be in charge of R E Thrush.

Crosby Steam Gage & Valve Co elects William P Husband Jr president and treasurer.

Boston office of **H K Porter Co** has moved to 294 Washington St.

H K Porter Co purchased **American Spiral Spring & Mfg Co** of Pittsburgh. The new acquisition, together with the present Porter Fort Pitt spring plant, will be operated as American-Fort Pitt spring div of H K Porter Co.

Henry A Mullen has been appointed manager, resistance welding sales, of **Ampco Metal, Inc,** Milwaukee.

American Pulley Co elects following officers: Frank E Brown, vice-president, in charge of sales and advertising; Caleb F Fox III, vice-president, in general charge of production; W Randle Mitchell, controller; William A Williams, chief engineer.

Charles A Flannery has joined **Joshua Hendy Iron Works,** Sunnyvale and Torrence, Calif., as manager of general products sales. Clifford A Patch has been appointed sales manager of western div, succeeding Clarence Jensky who has resigned. Sales of electric motors and generators made at Crocker-Wheeler plant, Ampere, N. J., remain under direction of L D Warner.

Noma Electric Corp announces appointment of George Wexler as manager of Mica-Capacitor div, Holyoke, Mass. William F Wimmer has been made director of order and service dept, air conditioner sales div, New York, N. Y.

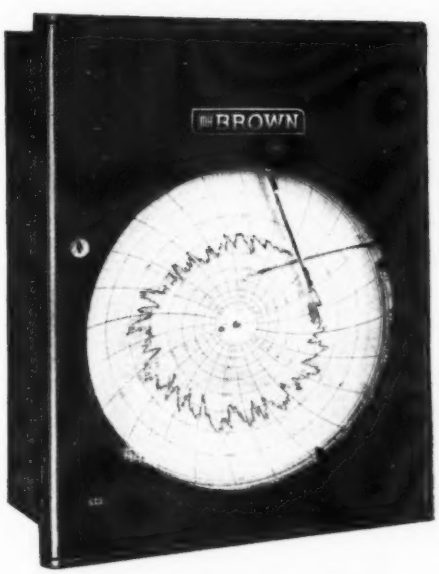
R L Hess Jr has been named secretary of **Rust Engrg Co,** Pittsburgh, Pa., and will also direct activities of the legal dept. He succeeds the late Ralph Bayard Baldridge. Dickson C Shaw III, an attorney in legal dept, will take Mr Hess' position as assistant secretary.

Builders Iron Foundry, Providence, R. I., announces formation of a new affiliate, Builders-Pacific, Inc, a California corp with offices, warehousing and service facilities in San Francisco and Los Angeles. Builders-Pacific will represent following

How Many Fuel Dollars

Are You WASTING ?

You Can Get the Answer with BROWN FLOW METERS



Brown Electric Recording Integrating Flow Meter

While other production materials and facilities are carefully computed, in many plants steam — an expensive production tool — is freely used and often wasted, without accounting.

Present day accounting methods call for accurate measurement of the steam used in each department so that costs can be properly allocated. Permanent records of departmental steam consumption are a real incentive to eliminate wasteful usage.

With Brown Flow Meters you *know* the cost of steam . . . *know* where it is going . . . *know* how many fuel dollars are saved or wasted.

Brown Flow Meter dual chart records show both rate and total flow — an exclusive Brown feature.

Write for catalogs 2008 and 2204-2. THE BROWN INSTRUMENT COMPANY, a division of Minneapolis-Honeywell Regulator Co., 4490 Wayne Avenue, Philadelphia, Pa. Offices in all principal cities. Toronto, Canada; London, England; Stockholm, Sweden; Amsterdam, Holland.

BROWN FLOW METERS

. . . MINNEAPOLIS-HONEYWELL CONTROL SYSTEMS . . .

Curtiss-Wright Assembly Plant, Robertson, Mo. *Albert Kahn Associated Engineers and Architects, Inc.*

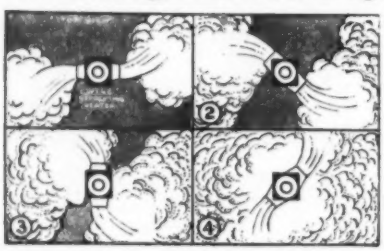
Revolving Unit Heaters Insure Complete, Thorough Coverage Regardless of Obstructions [in industrial plants as in airplane hangars]

Not just another unit heater, the WING REVOLVING HEATER is unique in that it does what no other heater can do—its slowly revolving outlets gently distribute the heat continuously in a constantly changing direction. It reaches over, around and under obstructions into out-of-the-way corners, its moving streams of heated air quickly warm up a plant in the morning.

ADVANTAGES OF WING REVOLVING UNIT HEATERS

1. **Makes workers feel comfortable, live and invigorated—more productive.**
2. **Reaches over and around obstructions and into out-of-the-way corners.**
3. **Moving discharge heats up plant quickly on cold mornings.**
4. **Reduces absenteeism due to colds resulting from drafts, chills or overheating.**
5. **Is an excellent cooling system in summer with steam off and fans on.**

Revolving Discharge Outlets for Thorough Heat Coverage



1. Heater starts. 2. 15 seconds later, 45° revolution. 3. 30 seconds later, 90%. 4. 45 seconds later, 135° revolution.

Wing Revolving Unit Heaters keep the heated air moving, circulating around obstacles, seeking out far corners, spreading an even, uniform, healthfully invigorating blanket of warm air over the entire working area.

Its properly warmed, healthful air currents thoroughly distributed, create a sensation of live, invigorating comfort for the workers. Wing Revolving Unit Heaters are used in many of the country's leading industrial plants. Write for a list of installations.

L. J. Wing Mfg. Co.
50 Seventh Avenue
New York 11, New York
Factories at Newark, N. J. and Montreal, Canada

Wing REVOLVING UNIT HEATERS

three affiliates of Builders Iron Foundry: Builders-Providence, Inc, Omega Machine Co and Proportioneers, Inc. Builders-Pacific will also represent the Walker Process Equipment, Inc., Aurora Pump Co and Ludlow Valve Mfg Co. Lee H Chamberlain is president and general manager of the new corp. He will be located in San Francisco office but will divide his time between that office and Los Angeles. Harold W Leeson will handle sales and service in Los Angeles area and as service manager will have charge of maintenance and repair service throughout the state.

A H E Berchem, Berchem Co, 50 Church St, New York 7, N. Y., has been appointed representative of **Valve & Primer Co** in New York City territory.

General Refractories Co names Stanley S Furst general sales manager and James P Raugh general works manager.

George C Connor has been appointed general sales manager of electronics div of **Sylvania Electric Products Inc.**

Forest S Burtch has been promoted to manager of sales, wire rope div, of **John A Roebling's Sons Co** and William Hobbs Jr to manager of sales, aircord div.

U. S. Rubber Co appoints William F Tuley operations manager for synthetic rubber div.

M W Kellogg Co elected E F Liebrecht a vice-president. He will have complete administrative direction of company's patent activities and handling of all licensing for the company and its associates.

W D Bickel has been named manager of power dept, machinery div. of **Dravo Corp;** T L Hartman, manager of piping dept of machinery div; and W G Greer, assistant labor relations manager.

Appointment of Wabash Equipment & Supply Co, 54 Monument Circle, Indianapolis, as distributor for **Davey Compressor Co** was announced.

Independent Pneumatic Tool Co, Chicago, announces opening of a branch sales office in St. Paul, Minn., under management of Joseph A Bell. New office serves all of Minn., eastern portions of N. and S. D., northwest portion of Wis. and upper peninsula of Mich.

S S Sulzycki became assistant secretary and controller of **Liquid Conditioning Corp.** Sidney Sussman has been made chief chemist and Marvin Lane assistant chief chemist.

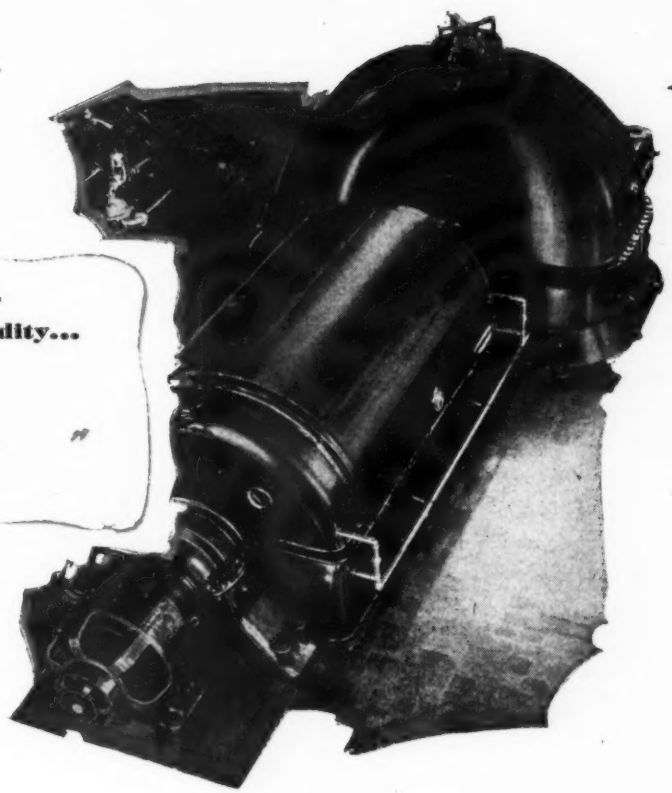
Holub Industries, Inc, a new concern organized by Bert E Holub, appointed Gordon W Wetzel sales manager.

Monsanto Chemical Co announces promotion of Donald H Powers to director of Merrimac div's textile chemical dept. Nate L Crabtree has been named to take charge of sales promotion activities of this dept. Sawyer Sylvester was named to head the dept's technical section. Ralph Nickerson,

"Peak Performance

AFTER YEARS OF CONTINUOUS OPERATION

with Tycol RIO turbine oils"



"No detectable sludge...
Negligible change in acidity...
No emulsification...
Viscosity unaltered...
No trouble with rust..."

These are some of the unusual features of Tycol RIO Turbine Oils which are contributing to the efficiency and economy of modern turbine operations. These highly-refined lubricants are engineered for purity . . . service endurance . . . and maximum oxidation inhibiting qualities.

For full information about the benefits of Tycol RIO Turbine Oils, call your nearest Tide Water Associated Office today.

TYCOL
INDUSTRIAL LUBRICANTS

Boston • Charlotte, N. C.
Pittsburgh • Philadelphia

TIDE WATER ASSOCIATED OIL COMPANY
17 BATTERY PLACE - NEW YORK 4, N. Y.

LUBRICATION—"ENGINEERED TO FIT THE JOB"

Gives You
LONG, TROUBLE FREE SERVICE

Fig. 1635

"STANDCO"
PILLOW BLOCKS

The attractive "Standco" Pillow Block shown above is sturdily built and is offered in a wide range of sizes. Babbitted and broached bearing surfaces, accurately machined faces. Can be amply lubricated.

Write for Bulletin

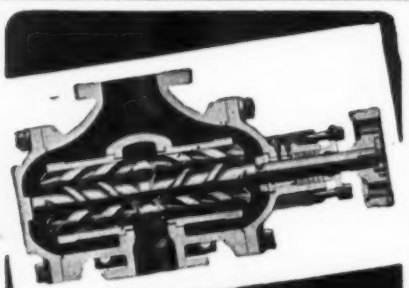
"Unbrako" and "Hallowell" products are sold entirely through distributors.

Over 43 Years in Business

STANDARD PRESSED STEEL CO.

JENKINTOWN, PENNA., BOX 577

Boston • Chicago • Detroit • Indianapolis
St. Louis • San Francisco



THE IMO PUMP IS RELIABLE BECAUSE IT IS SIMPLE....

The IMO pump has only three moving parts and no valves, timing gears, pistons, cams, vanes or delicate adjustments to get out of order or require maintenance.

IMO pumps have an outstanding record of trouble-free performance in lubrication, hydraulic, governor and fuel oil services.

For further information send for catalog I-135-P

IMO PUMP DIVISION
of the
DE LAVAL STEAM TURBINE CO.
TRENTON 2, NEW JERSEY

authority on cellulose, has been appointed to textile research dept of Merrimac div at Everett, Mass. Dr Nickerson joins Dr Oscar Cohen, recently appointed to the dept.

Hewitt Rubber of Buffalo, div of Hewitt-Robins Inc, appoints Monarch Rubber & Supply, Inc, as a distributor of its *Job-Engineered* industrial rubber products. This new concern serves San Francisco-Oakland areas at 546 Howard St, San Francisco. Larry J Burmester and J J Foutz are at the head of the new company.

Howard D Herbert has joined Restfoam sales dept of **Hewitt Rubber** at Buffalo headquarters. Philadelphia district office and warehouse moved to 401 N Broad St. New location is under supervision of C F Holden and Jack T Sheldon.

Robins Conveyors Inc announces that its Philadelphia office, formerly at 12 S 12th St, consolidated with its parent organization, Hewitt-Robins Inc, at 401 N Broad St, Philadelphia 8, Pa.

Wheelco Instruments Co, Chicago, names Farnes & Martig, Inc., 417 N E Couch St, Portland 14, Ore., as sales and service representatives for Ore.

Rogers Diesel & Aircraft Corp has changed its name to **R B Rogers Companies, Inc.**

American Foundry Equipment Co appoints Kenneth H Barnes chief engineer, Chalmer R Cline engineering assistant to president and Sherrill S Deputy assistant sales manager.

Alvin Haas has been named vice-president and general manager of **American Well Works,** Aurora. W N Remsburg has been made chief engineer of sanitary div. Added to "Doc" Remsburg's staff is Gerald E Hauer, a sanitary engineer.

American Well Works purchased the Atlas Foundry, Bloomingdale Rd, Chicago.

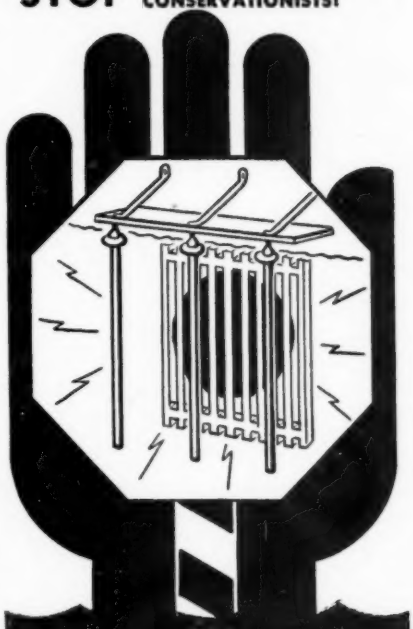
Detrex Corp announces appointment of William L McCracken to position of administrative assistant to C F Dinley Sr, vice-president in charge of research and engineering.

Sidney E McCrum has been made advertising manager of **Wickwire Spencer Steel Div,** Colorado Fuel and Iron Corp.

Dowell Inc announces following changes in sales staff: (1) H W Ross assumes duties of sales manager of industrial div, which is primarily concerned with removal of scale and sludges from industrial heat-exchange equipment. However, he will continue to maintain certain activities in petroleum div. (2) M L Stirling becomes sales manager of petroleum div and directs sales of Dowell's oil field services. (3) Guy Williams becomes assistant sales manager in charge of product sales. He will also be active in general sales promotion in industrial and petroleum divisions.

R E Wagenhals has been appointed director of quality control for all bearing divi-

STOP NEEDLESS DESTRUCTION OF FISH!
STOP HEAD LOSS . . . AT YOUR INTAKES!
STOP SCREEN MAINTENANCE WORRIES!
STOP CRITICISM . . . FROM CONSERVATIONISTS!



AN INVISIBLE BARRIER

YOUR ZONE of PROTECTION

Burkey Electric Fish Screens solve your fish control problems—cheaply, effectively, harmlessly. Electronic impulses keep fish of all sizes safely away from intakes or outlets. The electrode systems are custom-built for your particular intake—designed to permit a full head of water. No screen cleaning necessary.

Every Burkey installation is engineered to your problem regardless of size. Burkey Electric Fish Screens are thoroughly proven by years of service in condensing water intakes, hydroelectric plants, water systems and industrial pumping installations. Recommended by State Conservation Officials.

★ **SEND FOR LITERATURE AND QUOTATIONS**

ELECTRIC FISH SCREEN CO.
1130 N. Poinsettia Place • Hollywood 46, Calif

"I like the way they engineer 'em"

Men who design piping, and are therefore responsible for its efficient performance, safety and permanence, really appreciate the fine engineering that goes into WeldELLS — and all other Taylor Forge Welding Fittings.

They like the reinforcement at the inner arc where bursting stress is greatest — the tangents that keep the weld away from high stresses caused by line movements due to expansion.

They like the seamless construction, dimensional accuracy and precision quarter-marked ends. They realize, too, that with WeldELLS they get not only a better job but also one which is likely to be less costly.

Please note that each of the features listed opposite either provides better engineering or promotes convenience and economy. If you'll consider them for just a moment we believe you'll see why almost everybody agrees that, of all welding elbows, WeldELLS alone "have everything."

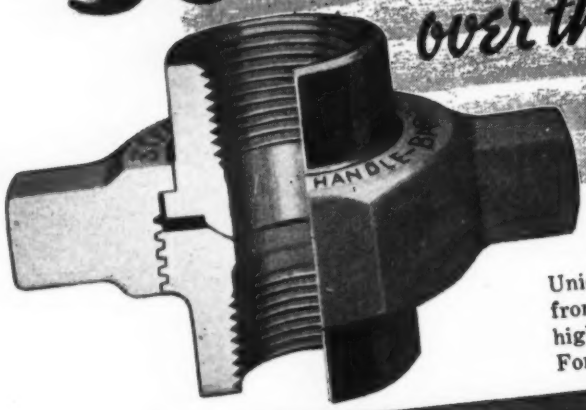
WeldELLS alone combine these features:

- **Seamless** — greater strength and uniformity.
- **Tangents**—keep weld away from zone of highest stress—simplify lining up.
- **Precision quarter-marked ends**—simplify layout and help insure accuracy.
- **Selective reinforcement** — provides uniform strength.
- **Permanent and complete identification marking**—saves time and eliminates errors in shop and field.
- **Wall thickness never less than specification minimum**—assures full strength and long life.
- **Machine tool beveled ends**—provides best welding surface and accurate bevel and land.
- **The most complete line of Welding Fittings and Forged Steel Flanges in the World** — insures complete service and undivided responsibility.

TAYLOR FORGE & PIPE WORKS

General Offices & Works: Chicago, P. O. Box 485 • New York Office: 50 Church Street
Philadelphia Office: Broad Street Station Bldg. • Los Angeles Office: Oviatt Bldg.

Service over the years with FORGED STEEL UNIONS



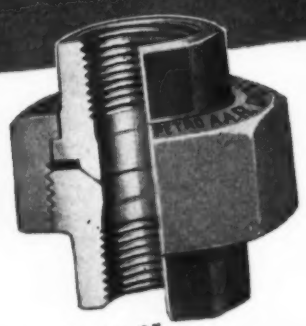
Unions are hot forged from solid round bars of high quality Open Hearth Forging Steel.

Handle-Bar

Hi-Speed Handle-Bar Unions with integral steel to steel seats, or completely fused bronze to bronze seats, black or Udylite (cadmium plated) — sizes from ⅜" to 4" inclusive in 4000 test, sizes 2" to 4" inclusive in 6000 test.

4000 Test Unions furnished with Briggs Standard steam threads in pipe ends, whereas the 6000 Test Union has long pipe ends with API line pipe threads. Nut threads are modified Acme to facilitate easy and speedy assembly and disassembly. Seat design is a 45 degree cone, machined and cold rolled, to a ball seat on male end. Handle-Bar Unions are recommended for all services where they are made up and taken down frequently.

Petro



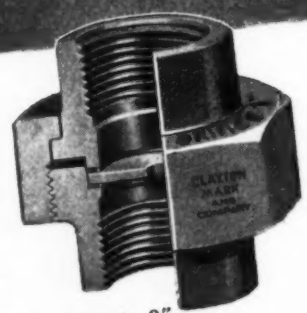
Sizes ⅛" to 3"

PETRO unions have integral steel to steel seats. Made to A. A. R. design. 600 lbs. S. W. P.-2000 lbs. C. W. P. Extra heavy ends and nut with nut threads that are permanently lubricated. The seats are machined and cold rolled.

Pressures from a vacuum to 3000 lbs.: Temperatures from 100° below zero F. to 1000° above zero F.: On Steam, Gas, Air, Oil, Gasoline, Ammonia, Chemicals, and any service in which Steel or Wrought Iron Pipe is used.

Orifice

Ideal for flow control of Steam, Oil, Ammonia, Water, Gas or Air. Also for metering and measuring. 600 lbs. S. W. P. or 2000 lbs. C. W. P. The ORIFICE plate is furnished in cold rolled 18-8 stainless steel. ORIFICE plate and gaskets are set in a groove of solid steel to safeguard against blowing of gaskets and resultant trouble. The ORIFICE union has extra heavy ends and nut with the nut threads permanently lubricated.



Sizes ¼" to 3"

ORDER BY TRADE NAME FROM YOUR LOCAL SUPPLY STORE

ORIGINATORS AND PIONEERS OF FORGED STEEL UNIONS SINCE 1912

CLAYTON MARK & COMPANY

1900 DEMPSTER STREET • EVANSTON, ILLINOIS

sions of **Timken Roller Bearing Co.** Sherman R Lyle was made sales engineer for Cleveland district, William Earle Bryden for Chicago district and Alfred J Kinnucan for New York district.

Appointments to four newly created sales posts and rearrangement of one New England and two southern sales areas have been announced by **Mathieson Alkali Works:** (1) Harold R Dinges has been named district sales manager of one of the new southern sales areas and will direct its activities from headquarters at Charlotte, N. C. (2) O J Theobald Jr has been elected to assist Mr Dinges. (3) Fred O Tilson, district sales manager of second newly defined southern area which will be serviced from Chattanooga, Tenn., will supervise company sales activities in parts of Tenn., Ala., and Ga. (4) William H Eastburn heads newly defined New England sales area as district sales manager and will direct sales activities from Providence, R. I.

Mathieson Alkali Works has entered fire protection field with high- and low-pressure carbon-dioxide equipment. Mathieson's carbon dioxide div has named Harry Ensminger to head fire protection dept at New York offices.

Roland S Higgins has joined **Hydropress, Inc,** New York City, as sales representative and head of their Detroit branch office.

Adel Precision Products Corp announces appointment of Ed J Towey as sales manager of industrial div.

Oster Mfg Co promoted Clare R Metcalf to secretary of the company.

West-Marquis, Inc., has been appointed advertising agency for **General Petroleum Corp.**

Hawaiian Electric Co appointed Paul Anderson vice-president.

Eugene William O'Brien, vice-president of W R C Smith Publishing Co, Atlanta, Ga., has been nominated for presidency of **American Society of Mechanical Engineers.** Election will be held this fall.

American Society for Metals announces five nominees for society's officers and trustees for 1946-1947: (1) Arthur L Boegehold was nominated for president. (2) Francis B Foley is vice-presidential nominee. (3) William H Eisenman, national secretary of ASM since its organization in 1918, was nominated for re-election. (4) John E Dorn and (5) Arthur E Focke were nominated for two year terms as trustees. Formal elections and induction into office will take place at ASM annual meeting in Atlantic City during week of Nov 18 as part of National Metal Congress & Exposition.

Following are officers of **Stoker Manufacturing Association,** as elected by board of directors at recent annual meeting at Colorado Springs: (1) *President*—Walter Sormane, Conco Engrg Works, Mendota, Ill. (2) *Vice-President*—George W Gra-

HAVE YOU AN OIL STORAGE TANK?

. . . if so, assure oil withdrawal in coldest weather with a G-FIN TANK OIL HEATER

Note These Advantages of the G-R G-FIN Tank Oil Heater

GREATEST HEATING EFFECTIVENESS . . . provided by the G-FIN elements which have six to eight times the heating surface of bare tubes

MOST COMPACT UNIT . . . fewer tubes and shorter shell for a given duty

LEAST PRESSURE DROP . . . has maximum free area and straight-through flow of oil

NO STRATIFICATION OR VAPOR BINDING . . . oil outlet at top of shell prevents dead pocket

USES LESS STEAM . . . heats oil only locally at point of withdrawal

FEWER TUBE JOINTS . . . resulting from small number of required heating elements

ACCESSIBILITY . . . easily examined and cleaned throughout entire length and diameter of heating elements

LEAKPROOF JOINTS . . . the conical ends of the heating elements are seated in the tube sheet with accurately machined metal-to-metal joints held tight by lock-nuts

NO TEMPERATURE STRAINS . . . the U-bend elements are free to expand or contract

Many hundreds of installations of the G-R G-FIN Storage Tank Oil Heater have fully demonstrated the speedy action, thorough reliability, low steam consumption, and economical maintenance of these units.

Users report that even in sub-zero temperature, or where oil has partly solidified through long periods of storage, these highly effective heaters assure a steady flow of oil soon after steam has been turned on.

Wherever fuel oil, lubricating oil, crude oil, road oil, tar, asphalt, glycerine, cotton seed oil, molasses or other viscous liquids are stored . . . at process plants or power plants, tank farms or distributing centers, loading wharves or platforms . . . the G-R G-FIN Tank Oil Heater is a necessary insurance against difficulties or delays in oil withdrawal. Available for installation outside of, or partly within the tank.

Write for Bulletin 1641 describing these units in detail.

THE GRISCOM-RUSSELL CO.

285 Madison Avenue **New York 17, N. Y.**

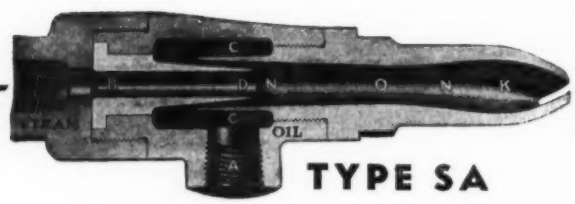
GR-183

GRISCOM-RUSSELL

Pioneers in Heat Transfer Apparatus

NATIONAL AIROIL BURNERS

FOR HEATING . . .
FOR POWER . . .
FOR PROCESS . . .



TYPE SA

Our Type SA Steam Atomizing Burner will help reduce labor and fuel costs.

Type SA Burners, for use with heavy fuel oils, generate steam for heating, power or processing, where either steam or compressed air is available. They *thoroughly atomize* and *completely burn* the lowest grades of fuel oil or tar, requiring low oil pressure and temperature.

Internal atomizing venturi feature assures low steam consumption and continuous operation without clogging or cleaning. For detailed information, write for Bulletin 21.

NATIONAL AIROIL BURNER
COMPANY, INCORPORATED
1250 East Sedgley Avenue
PHILADELPHIA, PENNA.

Texas Office: 2nd National Bank Bldg., Houston

OIL BURNER • GAS BURNERS • GAS PILOTS • PUMP SETS • EXPLOSION DOORS
ACCESS DOORS • AIR DOORS • BURNER BLOCKS • FURNACE OBSERVATION WINDOWS

NATIONAL AIROIL BURNER

National Airoil Burner Company, Inc.
1250 East Sedgley Avenue
Philadelphia 34, Pa.
Gentlemen:
Please send me your bulletin No. 21.

FIRM .....
ADDRESS .....
CITY ..... STATE .....
NAME ..... TITLE .....

ham, Eddy Stoker Corp, Chicago, Ill. (3) *Secretary-Treasurer*—Claude A Potts, U. S. Machine Corp, Lebanon, Ind. (4) *Staff Officials*—Marc G Bluth, executive secretary, and Lloyd L Connell, technical director.

Arthur W Carpenter, manager of testing laboratories of B F Goodrich Co, has been elected president of **American Society for Testing Materials.**

Ralston Russell Jr, director of ceramic research for Westinghouse Electric Corp, E Pittsburgh, Pa., joins **Ohio State University** staff Oct 1 as professor of ceramic engineering.

New address of western office of **Engineering Service, Inc,** is 406 E Colorado Ave, Glendale, Calif.

OBITUARIES

William Patrick Newman, retired purchasing agent of Robins Conveyors Inc, Passaic, N. J., div of Hewitt-Robins Inc, died July 17 after a brief illness.

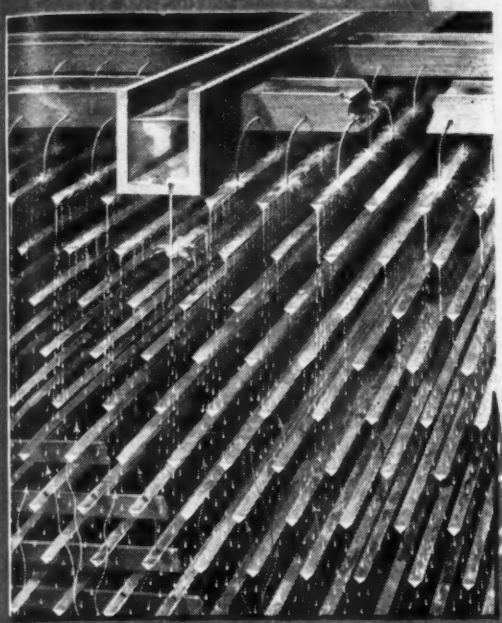
T W Clark, who has been associated with Strong, Carlisle & Hammond Co for over 30 years, died recently at Corry, Pa.

Ellsworth Marshall Rust, 67, vice-president of Rust Engrg Co, died at his Leesburg, Va., home on July 24.

William C Lewis, 71, chief operating engineer of Suburban Gas & Electric Co, Revere, Mass., since 1919, died on July 13.

One of the largest aircraft gas-turbine experimental projects sponsored by the Government will be carried out exclusively by recently organized De Laval aircraft gas-turbine div of De Laval Steam Turbine Co, Trenton, N. J. H L Watson, president, said details of the new aircraft gas turbine could not be made public, but project involves a new and unusual concept of compressor and gas-turbine design. Mr Watson mentioned that new project was the completion of first major step in a long-range engineering research program. New aircraft gas-turbine designs are identified with Rudolph Birman, consulting engineer, who for many years prior to the war was in charge of De Laval turbine design and, since 1937, has been prominently associated with research, design and manufacture of aircraft compressors and gas turbines.

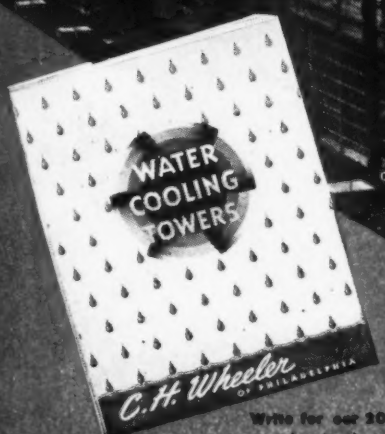
Three young research scientists, whose laboratory work already has produced important developments in physics, chemistry and mechanics, have been awarded Westinghouse research laboratories' $1000 scholarships for a year of post-graduate study. They are Julia Senko, Julius Miklowitz and Dennis R Turner—all members of the laboratory staff. Under the graduate scholarship plan, each recipient may select his university as well as the course he wants to pursue. Westinghouse research staff makes three awards each year to its young members.



COOLING TOWERS ENGINEERED FOR ANY CLIMATIC EXTREMES

C. H. Wheeler Water Cooling Towers are installed in practically every State and in many other countries where the weather is cold, such as Canada, arid as in Mexico, and tropical as in Colombia, South America. From this it is obvious that every water cooling tower presents its own individual engineering considerations, in order to insure correct operation under the climatic extremes of its location. . . . C. H. Wheeler Water Cooling Towers have one exclusive feature which is "Our Experience," and this is second to none. We have been building cooling towers since the days of horse cars and gas light, so today no water cooling problem would be new to us. We guarantee every one of our towers to produce the results for which it is designed.

C. H. WHEELER MFG. COMPANY
1800 SEDGLEY AVENUE, PHILADELPHIA 32, PA.
REPRESENTATIVES IN MOST PRINCIPAL CITIES



Write for our 20 page Catalog No. 148 which completely describes the operation and construction of our complete line of cooling towers.

C. H. Wheeler OF PHILADELPHIA

STEAM CONDENSERS · AIR EJECTORS
COOLING TOWERS · HEAT EXCHANGERS

Measure rpm with handy and accurate SCHERR instruments

HAND TACHOMETERS which allow you to measure rpm without timing or calculation. Each dial calibrated accurately for its particular instrument. Disc for measuring surface speeds in feet per min. Types for measuring speeds up to 48,000 rpm.

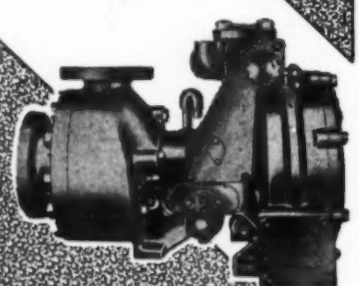
SPEED INDICATORS for direct readings in rpm also available in two sizes up to 20,000 rpm.

NEW BOOKLET on speed measuring instruments just off the press. Write for a copy.

GEO. SCHERR CO., Inc.
196-A Lafayette St.
New York 12, N.Y.

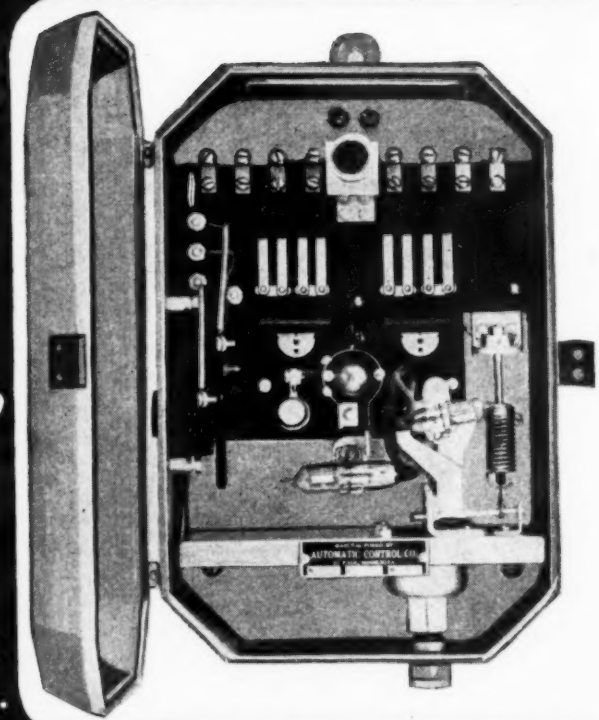
COFFIN TURBO PUMPS

FOR
BOILER
FEED AND
GENERAL HIGH
PRESSURE SERVICE



THE J. S. COFFIN, JR., CO.
ENGLEWOOD, NEW JERSEY

Here's the NEW Pump Saving Control



AUTOMATIC CONTROL CO.

PROTECTROL

PREVENTS DRY PUMP OPERATION

PROTECTROL will give you the pump protection you have always needed—if your primary control calls for pump operation, and water is *not* discharged,—PROTECTROL stops the pump, locks out the starter until PROTECTROL is *manually* reset. It also rings alarm bell and lights warning signal. It prevents damage to bearings and excessive wear caused by running the pump dry. PROTECTROL can be used with any make of pump or automatic control.

PROTECTROL is better than an insurance policy,—it prevents damage before it occurs. One undiscovered dry pump run may cause far more damage and expense than the cost of a PROTECTROL which will give positive protection permanently. Write for Bulletin T-1130. State your requirements and engineering data will be furnished.

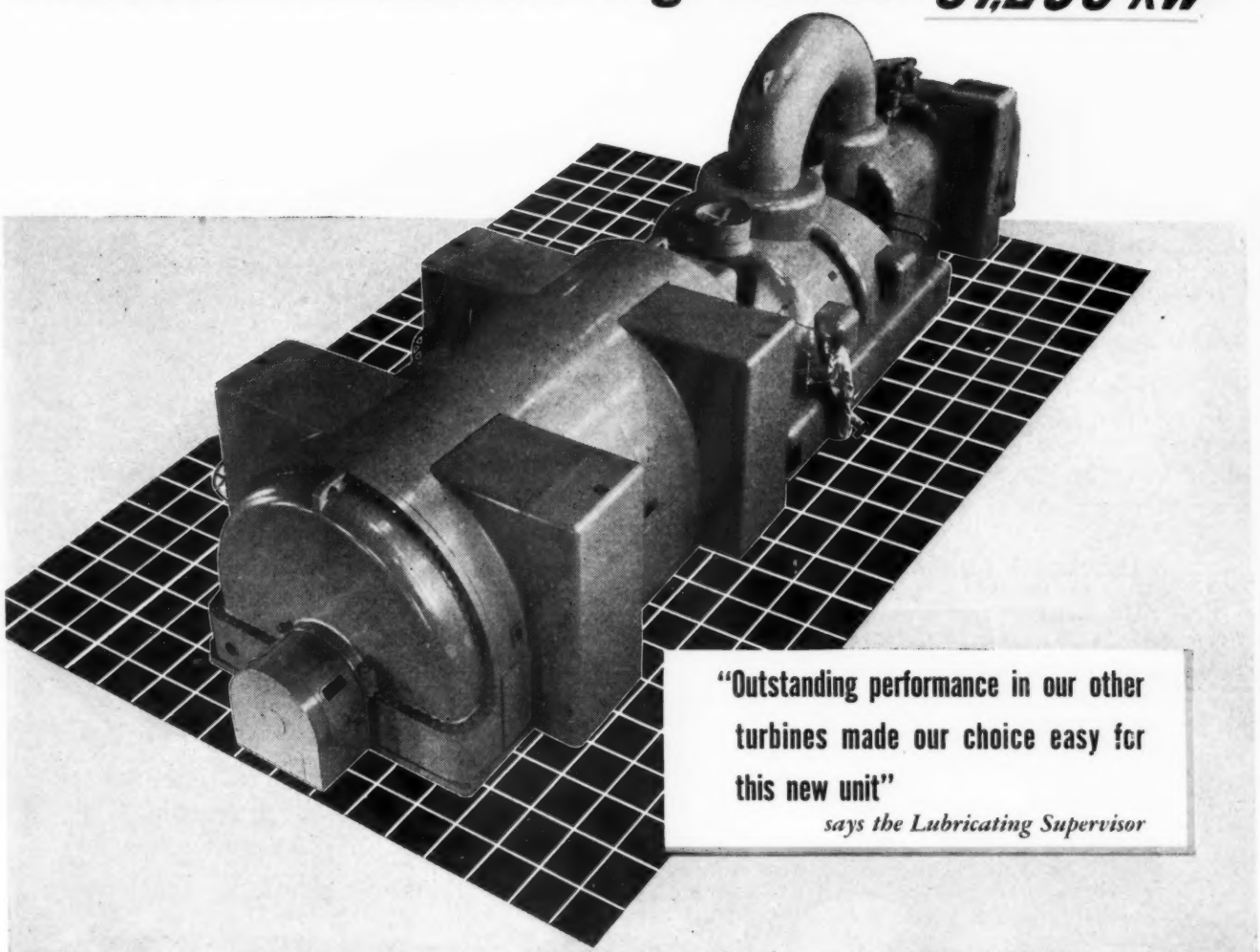
"AUTOMATIC" also makes pressure and float operated pump controls: multi-circuit sequence type, multi-circuit program type, float switches, automatic alternators, and many special controls built to specifications.

AUTOMATIC CONTROLS are used by all leading pump manufacturers. When ordering new pumps, specify controls by AUTOMATIC CONTROL CO.

AUTOMATIC CONTROL Company
1009 UNIVERSITY AVE., SAINT PAUL 4, MINN.

GULFCREST OIL

selected for another big turbine—81,250 kw



"Outstanding performance in our other turbines made our choice easy for this new unit"

says the Lubricating Supervisor

Another big turbine gets the long lasting protection of Gulfcrest, the world's finest turbine oil!

Another case, too, where unmatched performance in other turbines in the same plant narrowed the choice to Gulfcrest Oil for the new unit!

Over 75,000 hours in service in the plant's 40,000 kw. unit, for example, and still providing excellent lubrication—with a very low neutralization number and very little make-up required. Before Gulfcrest Oil was put in service in this unit, conventional turbine oils lasted less than 10,000 hours.

Extra refining makes the difference! Gulfcrest Oil is not only refined by conventional methods, but is super-refined by the Alchlor Process, which weeds out the sludge formers—the undesirable hydrocarbons—in oil. The Alchlor Process also imparts to Gulfcrest Oil greater ability to benefit from the addition of special inhibitors which control oxidation and prevent increase of viscosity.

Call in a Gulf Lubrication Engineer today and ask him to recommend the proper grade of Gulfcrest Oil to provide the best lubrication for your turbines. Write, wire, or phone your nearest Gulf office.

Gulf Oil Corporation · Gulf Refining Company

Division Sales Offices:

Boston · New York · Philadelphia · Pittsburgh · Atlanta
New Orleans · Houston · Louisville · Toledo

GULF INDUSTRIAL LUBRICATION

Gulf Oil Corporation · Gulf Refining Company P
3800 Gulf Building, Pittsburgh 30, Pa.

Please send me, without obligation, a copy of your new booklet "Gulfcrest Oil for Steam Turbine Lubrication."

Name.....

Company.....

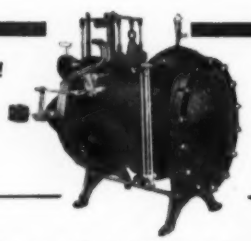
Title.....

Address.....

(IT IS REASONABLE TO ASSUME)
THE COST OF
COAL
WILL CONTINUE TO
RISE

The STERLING SYSTEM will save you from 10 to 50% on the cost of fuel. A unique gravity system using 90% less steam than efficient pumps. Handles condensate above 212 degrees—eliminates the use of electricity entirely. Send us your steam problem!

AUTOMATIC!
POSITIVE!
EXCLUSIVE!
UNIQUE!



Sterling Engineering & Mfg. Corp.
(Templeton Mfg. Co.)
110 Business St.,
Hyde Park, 36, Massachusetts

ADACAST

a castable refractory that pours like cement excellent for:

casting
BURNER BLOCKS
and DOOR LININGS
constructing
INTRICATE SHAPES
and BAFFLES

Adacast is structurally strong, with unusual resistance to spalling. It will stand heavy loads without bulging or distortion. Sets with high tensile strength and extreme density. Shows great stability; shrinkage or expansion are practically nil, permitting form to be made actual size. *So easy to handle that unskilled plant labor can produce fine finished results.*

BOTFIELD
REFRACTORIES CO.
784 S. Swanson St., Philadelphia 47, Pa.
In Canada, Canadian Botfield Refractories Co., Ltd., 171 Eastern Avenue, Toronto

LOW COST
DEMINERALIZED
WATER

WILL REPLACE EXPENSIVE DISTILLED WATER IN THE MAJORITY OF APPLICATIONS

★ Demineralized Water suitable for many requirements demanding distilled water, can now be obtained at a fractional part of the cost of distillation. Belco deliveries are surprisingly rapid.

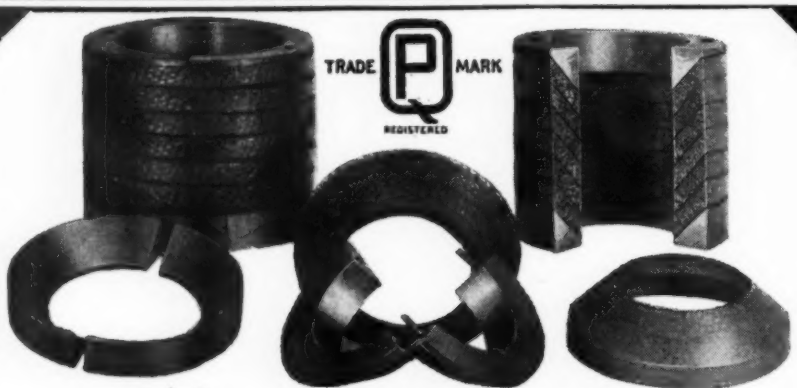
MODERNIZE YOUR ZEOLITE WATER SOFTENERS

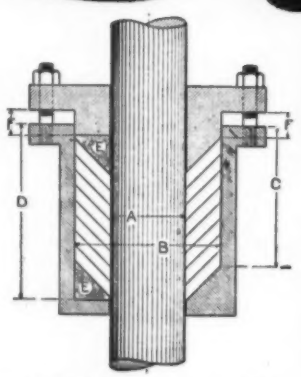
The new Belco zeolite will increase the capacity of industrial softeners up to six times as much. Ideally suited for modernization of present equipment. Belco engineers are always available to help you.

BELCO
INDUSTRIAL EQUIPMENT
DIVISION
50 IOWA AVENUE
PATERSON 3,
NEW JERSEY

CHECK WITH BELCO...first!

Belco
INDUSTRIAL PROCESSING EQUIPMENT
SINCE 1892



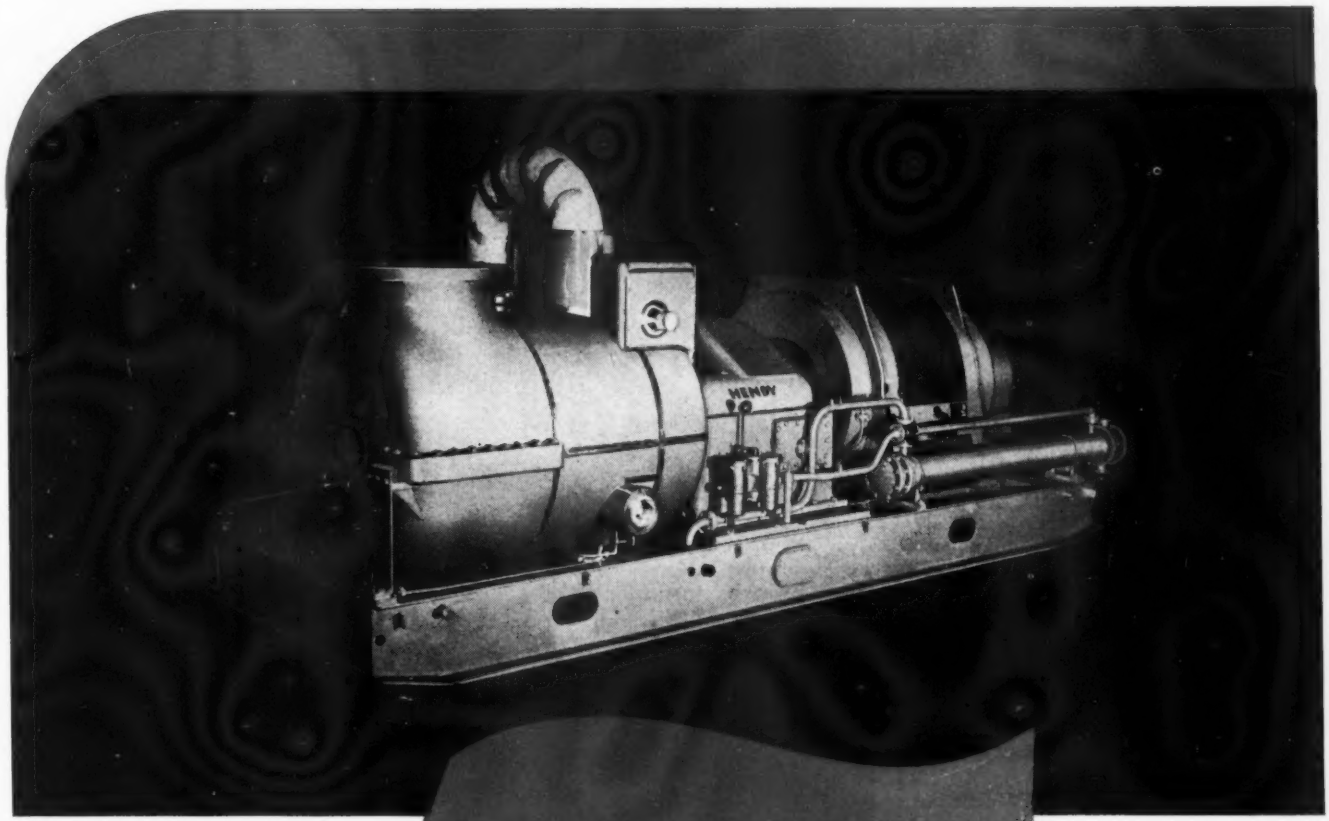


Self-Setting
PACKING

Q-P Self-Setting Packing has demonstrated its superiority under the most difficult conditions on land and sea and can be depended on to meet post war requirements for high maintenance economy. It is the ideal packing for superheated steam, saturated steam, hot and cold water, ammonia, fuel oil, compressed air, gases and acids and other operating conditions. (For Valves, Turbines, Diesels, Expansion Joints, Hydraulic Equipment, etc.).

(Outline your Packing Problems and Let us show you what "Q-P" Self Setting Packing can do for you.)

THE Q-P MANUFACTURING COMPANY
NEEDHAM HEIGHTS 94, MASS.



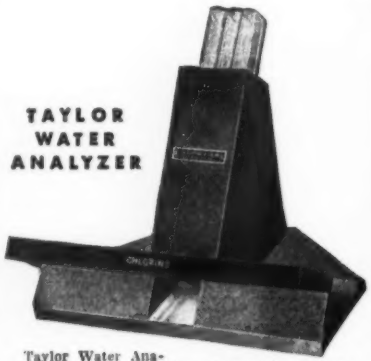
WHIRLWIND OF POWER . . .

The Hendy turbine is the last word in power . . . streamlined, up-to-the-minute design in every detail . . . features born of war-experience and proven in use in the field . . . and above all, top performance at low cost. Write for Literature describing Hendy steam turbines and turbo-generators. 200 kw. to 7,500 kw.

Power by Hendy

ENGINEERED TO SUIT YOUR NEEDS

Joshua Hendy Iron Works, Est. 1856
Plants: Sunnyvale and Torrance, California.
Crocker-Wheeler Electric Division, Ampere, New Jersey.
Sales offices: Boston, Buffalo, Chicago, Cincinnati,
Cleveland, Detroit, Los Angeles, New York,
Philadelphia, Pittsburgh, San Francisco, Washington.



Taylor Water Analyzer . . . ideal for determining silica, chlorine, ammonia, pH of condensate, etc. All slides for these determinations may be used with this single base.

Check
Your Boiler Water with *Taylor Comparators*

peration is simple . . . move the slide beneath the prepared sample until a color match is obtained and read the silica content, etc., from the values on the slide. Specialized inexpensive outfits are available for determinnig phosphates, pH, nitrates and polyphosphates. All outfits are light, durable and completely portable. All Taylor Color Standards carry AN UNLIMITED GUARANTEE AGAINST FADING. The comparator you need is in this list:

pH Comparators covering range 0.2 to 13.6

Long Range pH Comparator
Water Analyzer

Dalite pH Comparator
High & Low Phosphate Comparators

Boiler Water Comparator
(pH & Phosphate)
Polyphosphate Comparator

Enslow Slide Chlorimeter
Nitrate Comparator

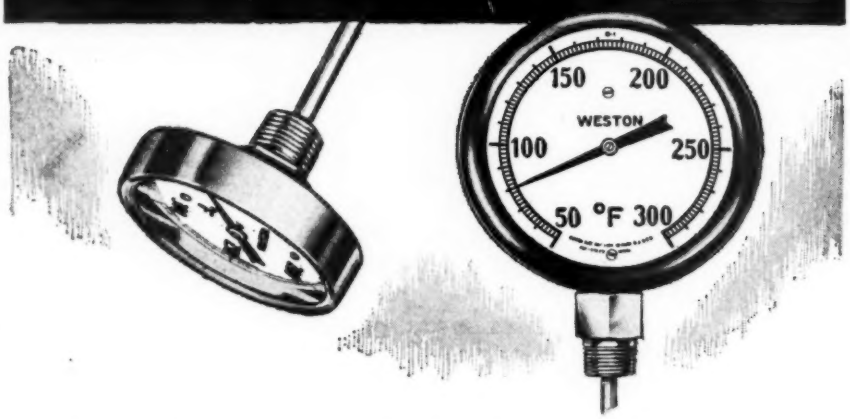
THIS FREE BOOK TELLS YOU HOW TO CUT STEAM COSTS!

88-page book gives applications to all types of power plant needs, illustrates and describes outfits which have proved their worth to men such as you . . . gives full details. See your dealer today . . . or write direct to:

W. A. TAYLOR AND CO.
YORK & ROGERS FORGE RDS. - BALTO 4, MD.

Available from Stock!

WESTON
all-metal THERMOMETERS

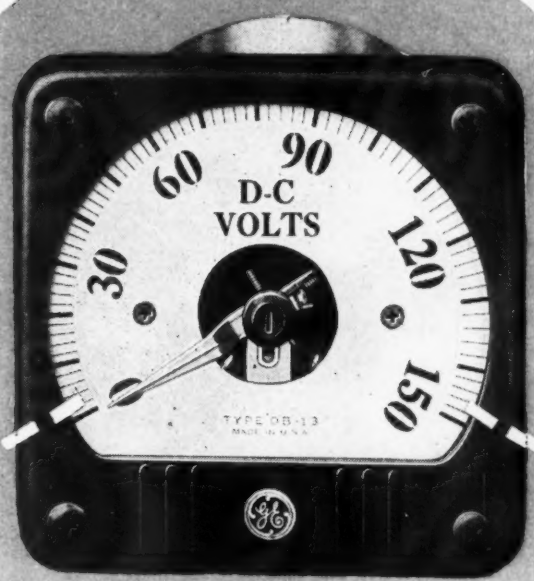


Expansion in production facilities has kept pace with the increasing demand for WESTON all-metal thermometers, thus prompt deliveries of catalogued models are assured. In most standard ranges and stem lengths, spot shipments can be made from stock.

The WESTON thermometer is of rugged, *all-metal* construction, with large *legible* scales. Available in ranges from -100 F. to +1000 F. and -100 C. to +400 C. Scale lengths from 6" to 12". Stem lengths from 2½" to 60". Accuracy guaranteed. Available through your local jobber or WESTON representative.

WESTON ELECTRICAL INSTRUMENT CORPORATION
679 Frelinghuysen Avenue, Newark 5, New Jersey

a 4¼" instrument with a 7" scale



TYPES

AB-13—A-C

DB-13—D-C

VOLTMETERS
A-C & D-C

AMMETERS
A-C & D-C

WATTMETERS

VARMETERS

POWER-FACTOR METERS

SYNCHROSCOPES

FREQUENCY METERS

ALSO

Temperature Meters

Tachometers

Easy to read—accurately

Concentric-scale instruments mean a 36 per cent longer scale in 40 per cent of the panel space—for that is the comparison between the G-E long-scale, 4¼-inch switchboard instrument and the conventional-scale, six-inch rectangular, semiflush switchboard instrument. Here is what the long (7-inch) scale, spanning 240 degrees, means to you:

For voltage—The extra length permits more precise control of station bus voltage. See how easy it is to read to one volt on the scale.

For current—Readings can be taken from full scale down to approximately 10 per cent of this value, thus extending the useful range.

For power—Wattmeters and varmeters not only have long scales, but the divisions are evenly spaced throughout—an added advantage contributing to more accurate readings.

For frequency—The 7-inch scale, calibrated 55-65 cycles, permits closer readings; more precise control.

For temperature—The scale, nearly twice as long as usual, permits closer watch over critical heating.

Other accuracy features—One per-cent accuracy rating, thorough shielding, antiparallax scale and pointer, and non-glare glass.

Insist on G-E concentric-scale instruments for all new installations. Write your nearest G-E sales office for Bulletin GEA-3432. *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*

HEADQUARTERS FOR MEASUREMENTS

GENERAL ELECTRIC

She needs your scrap to make steel NOW

THE present critical shortage of scrap is a serious threat to steel production.

America was literally picked bare of scrap during the war years. In recent months, industries which usually generate large quantities of scrap have been operating at low level or not at all. The result is that scrap inventories at the mills are little better than in 1942 when some open hearth furnaces were forced to shut down for lack of scrap.

Every user of steel has a direct stake in the scrap shortage. Without more scrap, producers cannot furnish you the steel needed so urgently now.

If you want steel, you can help yourself to get it by doing your bit immediately to start more scrap into channels that serve the steel mills.

QUALITY YOUNGSTOWN SERVICE

YOUNGSTOWN

THE YOUNGSTOWN SHEET AND TUBE COMPANY

GENERAL OFFICES - YOUNGSTOWN 1, OHIO

Export Offices - 500 Fifth Avenue, New York City

Manufacturers of

CARBON - ALLOY AND YOLOY STEELS

Pipe and Tubular Products-Sheets-Plates-Conduit-Bars-Electrolytic Tin Plate-Coke Tin Plate-Rods-Wire-Cold Drawn Carbon Steel Rounds - Tie Plates and Spikes.

ENGINEERING PROGRESS REPORT # 4

LJUNGSTROM AIR PREHEATER

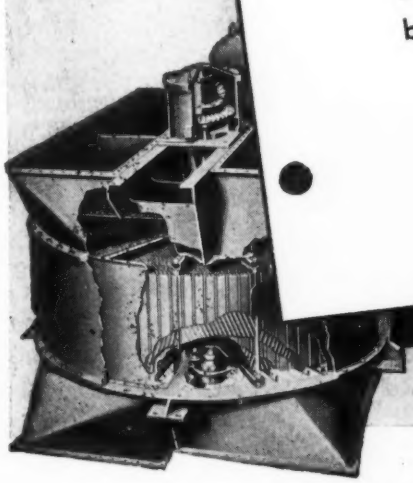
Trend to High Heat Recovery Stimulated by Preheater Progress

In modern boiler plants, high-temperature preheated combustion air is a subject of ever-increasing importance.

Among the benefits of improved combustion with preheated air are:

1. Improved ignition rate and stabilized flame.
2. Increased furnace capacity.
3. Low exit gas temperatures result in greater fuel savings.
4. Proper mill drying of the coal with pulverized coal firing.

The Ljungstrom air preheater maintains a uniform heat recovery performance. It makes possible maximum recovery and highest air temperatures, thereby maintaining all the benefits of high temperature preheated air.

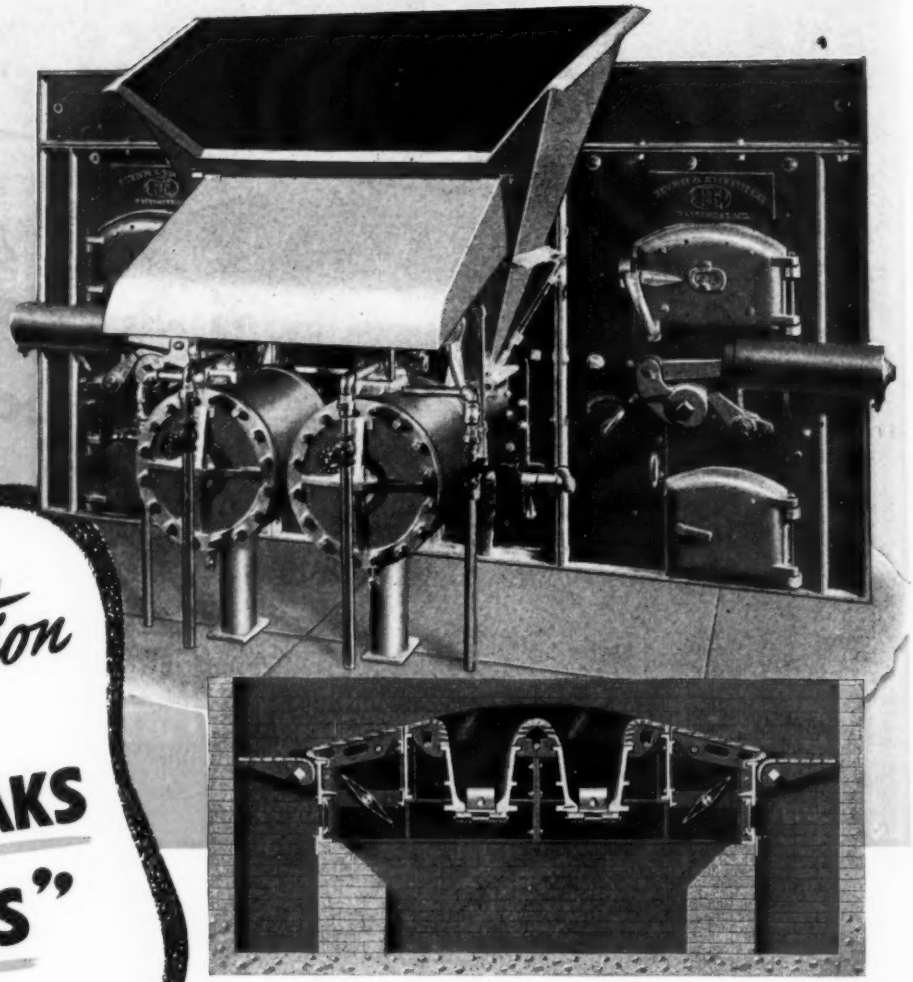


THE

AIR PREHEATER

CORPORATION

Executive Offices: 60 East 42nd Street, New York 17, N. Y. • Plant: Wellsville, N. Y.



Front of "F & E" Series 70-S Underfeed Stoker, direct steam ram type double retort with stationary grate. Entire front is of heavy cast iron. Fire doors are equipped with safety latches. Ample size ashpit and clean-out doors. Steam ram drive available in either stationary or moving grates. Electro-hydraulic ram drive optional.

When in Action ...IT "SPEAKS VOLUMES"

Cross-section of double retort stationary grate stoker, equipped with "F & E" air zoned windbox. Close spacing of the bearing bars gives rigid and durable construction. All "F & E" tuyeres and grates are made of heat-resisting metals and designed to deliver air to fuel bed in correct proportions and pressures.

Teamed up with boilers called upon to produce 25,000 to 40,000 pounds of steam per hour, the "F & E" Series 70-S, double retort Underfeed Stoker, with built-in reserve ruggedness, settles down to a tireless, steady pace, delivering steam-power in uninterrupted, dependable volume.

The steam drive of "F & E" 70-S, simple, direct and economical, operates the ram by steam direct from boiler, eliminating all intermediate driving equipment. The "F & E" patented automatic Interval Timer Governor makes possible *that full stroke, full speed ram action* at any coal feeding rate, a proved essential to efficient fuel burning.

Only in "F & E" Stokers are found the combination of six engineered features that dove-tail into an accurate firing mechanism, resulting in a concentrated self-contained assembly.

Check with your consulting engineer or local "F & E" Representative on "F & E" Series 70-S Stoker applications with industrial boilers in prominent plants and large buildings.

FLYNN & EMRICH CO.

Established 1842

HOLLIDAY & SARATOGA STREETS, BALTIMORE 2, MARYLAND

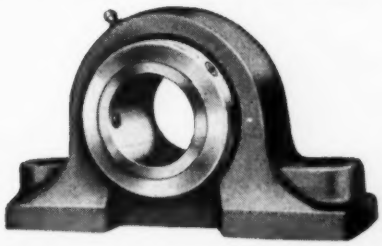
Representatives in Principal Cities

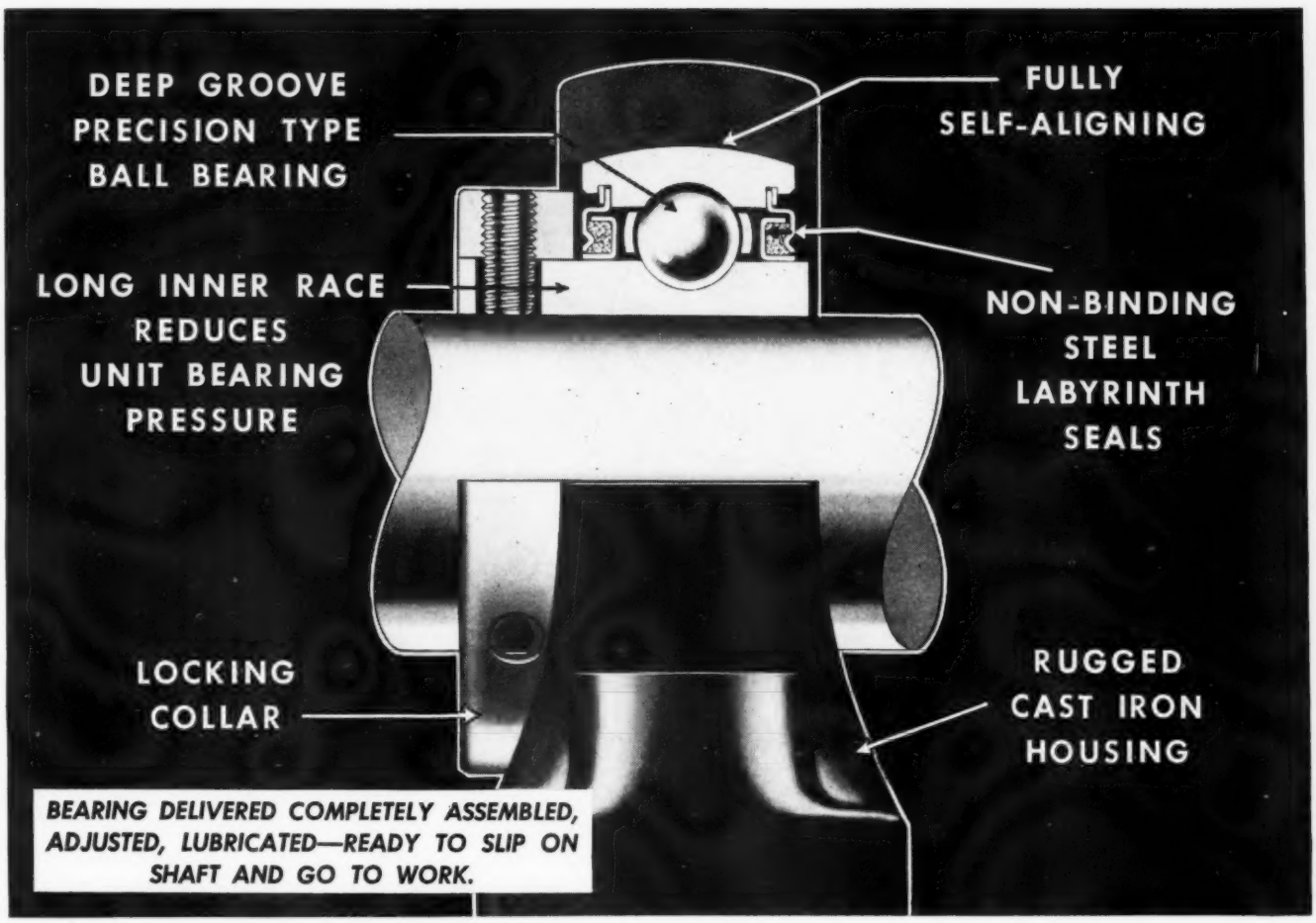
F&E *Underfeed Stokers*

HYDRAULIC DRIVE AND STEAM DRIVE FOR BOILERS PRODUCING 10,000 TO 40,000 LBS. OF STEAM PER HOUR

A NEW BALL-BEARING PILLOW BLOCK

in the
Famous 30,000 Hour Line




DEEP GROOVE PRECISION TYPE BALL BEARING
FULLY SELF-ALIGNING
LONG INNER RACE REDUCES UNIT BEARING PRESSURE
NON-BINDING STEEL LABYRINTH SEALS
LOCKING COLLAR
RUGGED CAST IRON HOUSING
BEARING DELIVERED COMPLETELY ASSEMBLED, ADJUSTED, LUBRICATED—READY TO SLIP ON SHAFT AND GO TO WORK.

DODGE
MISHAWAKA

If you are looking for a practical anti-friction bearing for small shafts, operating under moderate load conditions, be SURE to investigate the new Dodge SC. It has *every*-thing—high precision, modern styling, rugged cast iron housing, locking collar, radial and thrust load capacity. Self-aligning and sealed against loss of lubricant or admission of dirt. It is a completely assembled, pre-lubricated, factory-adjusted unit which comes to you ready for installation and years of smooth, uninterrupted service.

This bearing is available from stock in shaft sizes ranging from 11/16" to 2-1/4". For prices and delivery call the Dodge Transmissioneer, your local Dodge distributor. Look for his name under "Power Transmission Equipment" in your classified phone book. Or write

DODGE MANUFACTURING CORPORATION, MISHAWAKA, INDIANA

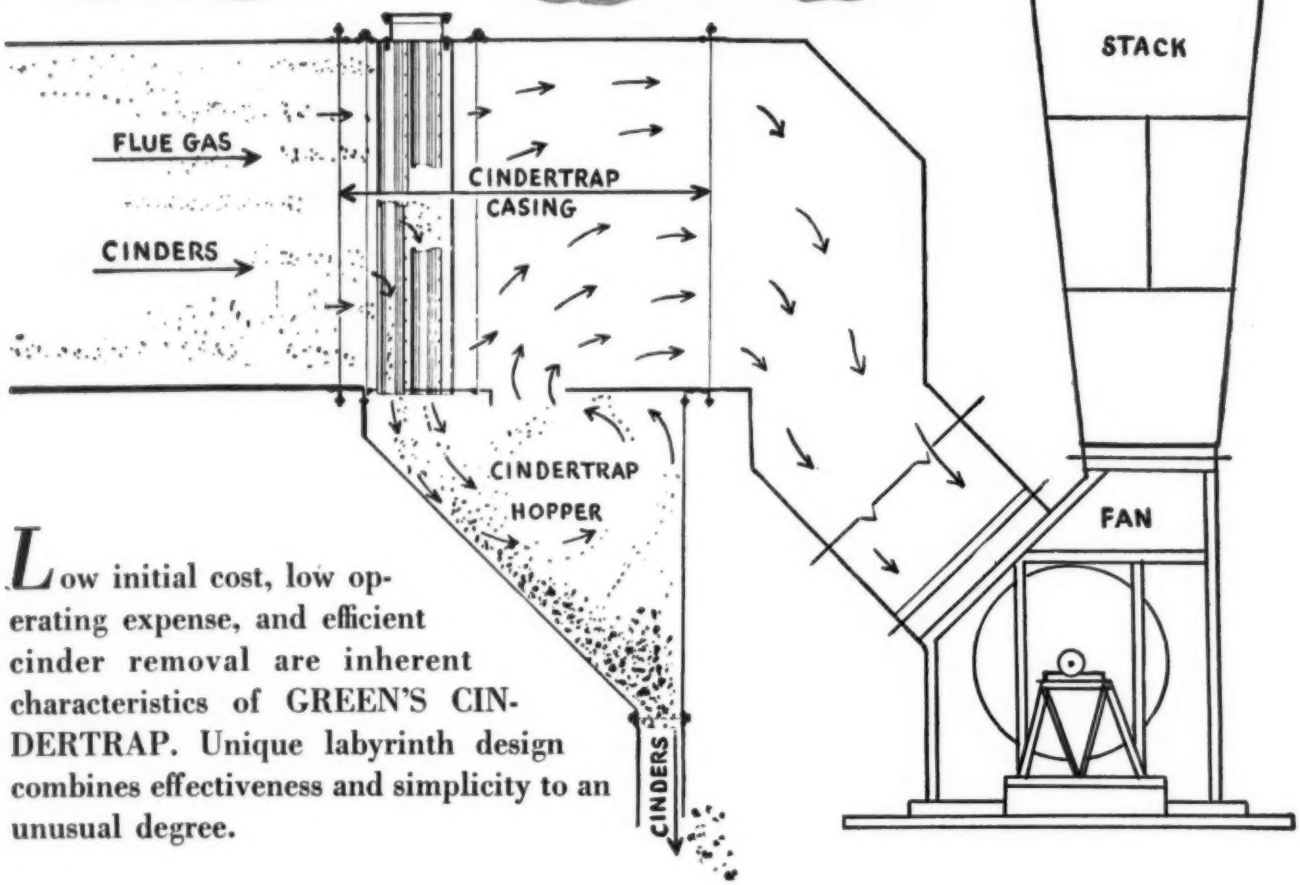
THE SYMBOL THAT CAME TO LIFE

The man who walks into your factory wearing this symbol is the living embodiment of a service which gives you the correct answer to your problems in efficient mechanical transmission of power. He is the Dodge Transmissioneer.

Copyright, 1946, Dodge Mfg. Corp.

NAME PLATES — FOR YOUR NAME PLATE REQUIREMENTS, WRITE OUR SUBSIDIARY, ETCHING COMPANY OF AMERICA, 1520 MONTANA STREET, CHICAGO 14, ILLINOIS

CATCH CINDERS .... at Low Cost!



Low initial cost, low operating expense, and efficient cinder removal are inherent characteristics of GREEN'S CINDERTRAP. Unique labyrinth design combines effectiveness and simplicity to an unusual degree.

EFFECTIVE: Traps from 75% to 96% of the cinders in flue gas.

Unaffected by variations in cinder concentration.

Patented design prevents clogging.

ECONOMICAL: Low initial cost . . . long life.

Fits readily into existing systems.

No moving parts . . . no water spray.

No replacement parts have ever been required.

Low draft loss (0.2" maximum).

Efficient for stokers.

For complete details send for Bulletin 163-A

NOTE THESE REPEAT ORDERS!

Boston Elevated Ry. Co.; Brooklyn Edison Co.; Calco Chemical Co.; City of Fort Wayne, Ind.; City of Wyandotte, Mich.; Continental Paper Co.; Defense Plant Corp.; Eastman Kodak Co.; Fitchburg Gas & Electric Co.; General Electric Co.; Interboro Rapid Transit Co.; Knott Hotels Corp.; Lorain Steel Co.; New York Navy Yard.; Pennsylvania Power & Light Co.; Pennsylvania R.R. Co.; Peoples Gas & Electric Co.; Phoenix Utility Co.; Pullman-Standard Car Mfg. Co.; Scranton Electric Co.; Stone & Webster Engineering Corp.; J. G. White Engineering Co.

THE GREEN Fuel Economizer COMPANY INC.

BEACON 2, NEW YORK

ALL-CURVE CORRUGATIONS

and

DIRECTED FLEXING EQUALIZING RINGS

MEAN EVEN DISTRIBUTION OF STRESSES . . . LONGER LIFE

E. B. Badger & Sons Company is the original and sole manufacturer of BADGER Expansion Joints

1. Corrugations in ALL-CURVE design to prevent localizing of stresses.

2. DIRECTED FLEXING Rings (patented), also in ALL-CURVE design, to equalize stresses among the corrugations and also within each corrugation.

3. One-piece construction to eliminate packing maintenance, manhole construction and tunneling expense.

4. Special forming methods to avoid structure-weakening forming stresses.

5. Special heat-treatment to preserve flexing qualities.

6. Compact design to require no more space than a regular flanged fitting.

There you have six great features that leave no doubt as to which is the strongest, surest acting, longest lived, most economical and most easily installed high-pressure and high-temperature pipe expansion joint offered.

Badger Packless DIRECTED FLEXING Corrugated Expansion Joints are built with *known factors* that leave nothing to guesswork. You can readily determine the number of corrugations needed, since the maximum traverse per corrugation is consistent for each size. For example:

Diameter	*Depth of Corrugation*	*Traverse per Corrugation*
4" and 5"	1⅛"	5/16"
6"	1¾"	½"
8" and 10"	2¼"	5/8"
12" and larger	2¾"	¾"

MADE IN COPPER, STAINLESS STEEL AND OTHER ALLOYS — Copper for normal pressures and temperatures; Stainless Steel and other alloys for higher requirements—and where corrosion is a problem. Single or multiple corrugations—for traverses from a fraction of an inch upward. Also made in Non-equalizing type (without rings) for uses that do not require added protection. SEND FOR BULLETIN No. 100 *(Self-equalizing)* or No. 200 *(Non-equalizing)*.

Badger

E. B. BADGER & SONS CO., 75 Pitts St., Boston 14, Mass.

AGENTS IN PRINCIPAL CITIES

PACKLESS CORRUGATED EXPANSION JOINTS

In Step with Industry

Paracoil

HEAT TRANSFER EQUIPMENT

Davis Engineering Corporation has played a major part in the development, design betterment and manufacture of distillation, evaporation and heat exchange equipment for more than 30 years.

Pictured are Paracoil Heat Transfer units designed to serve America's industries as well in peace as they served the country during the war. Davis built heat exchangers assure greater production efficiency, reduced repair and cleaning costs and freedom from shutdown losses.

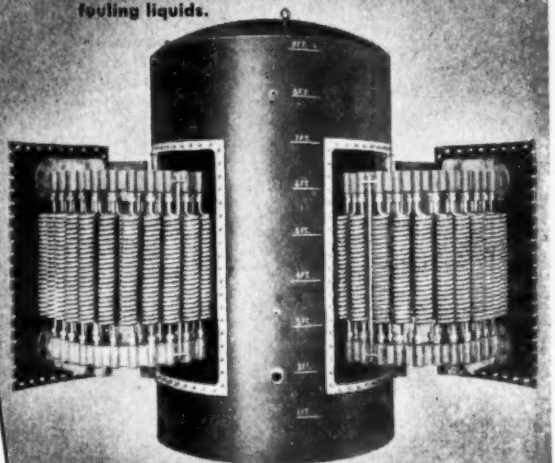
Paracoil equipment is available for practically every type of heat transfer application called for by our many and varied industries.

Technical and practical knowledge accumulated from 30 years of manufacturing experience and job performance, supplemented by continuous engineering research, have resulted in fundamental design improvements effecting advanced performance and increased resistance to severe service conditions.

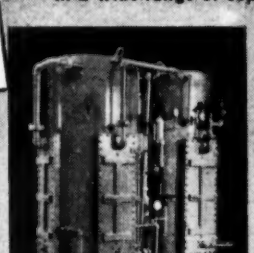
Whether yours is a replacement, new, or more efficient equipment need, Paracoil Heat Exchangers are available on most reasonable delivery schedules and Davis engineers are ready to assist in making proper selection of size and design best suited for your particular problems.

To those with fouling problems: Write for bulletin HE-100 describing the Paracoil Self-Cleaning Tubular Heat Exchanger.

Paracoil Self-Cleaning Heat Exchanger. By moving the hand-wheel clockwise and counter clockwise the entire baffle-assembly is moved back and forth over the heating surface thus scraping any deposits from the tubes. Cleaning action is positive and effective. Ideal for heating fuel oil and other fouling liquids.

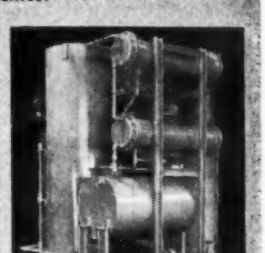


Paracoil Double-Door Evaporator. Note accessibility of all the heating surface for inspection, cleaning and ease of repair. Available in single and multiple effects and in a wide range of capacities.



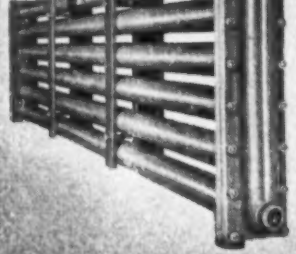
FRONT VIEW

Triple Effect Package Type Distillation plant built for supplying distilled water from sea water or contaminated water for drinking and process service. Illustrates Paracoil hinged door evaporators. A completely self contained unit.



BACK VIEW

This distillation unit has a capacity of 180 gallons per hour with low pressure steam and economical steam consumption. Other package types standardized for a number of capacities.



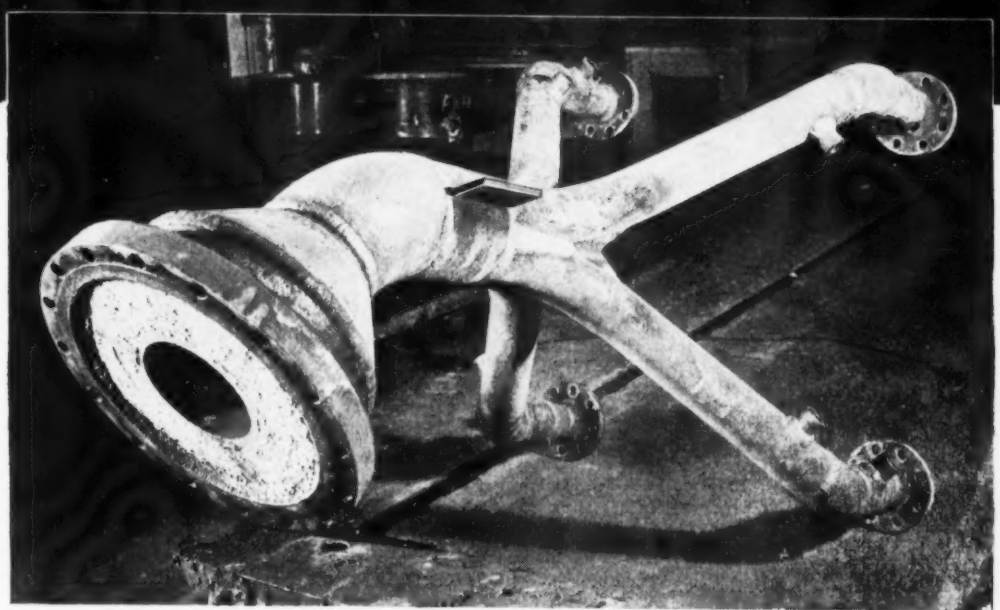
Gas to Gas Heat Exchanger. This type of Paracoil Heat Exchanger has many industrial uses for transfering heat between gases or liquids, or between gases and liquids. Unit illustrated constructed entirely of Inconel. Can be furnished in other alloys or carbon steel.

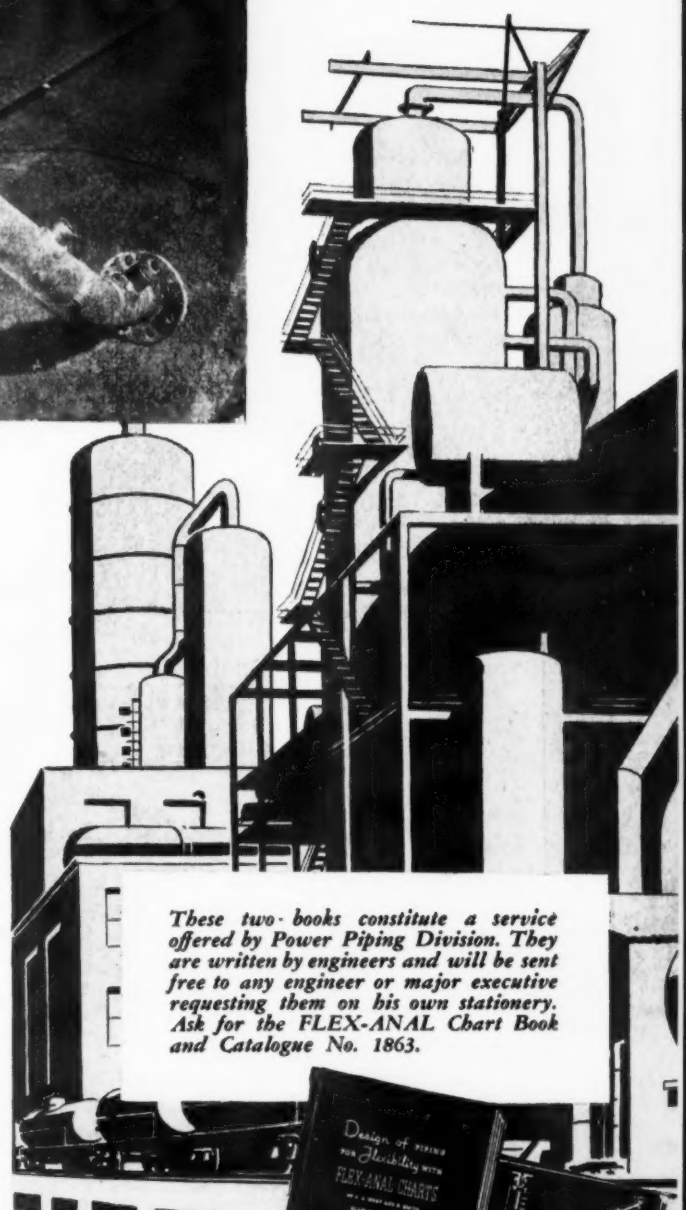
Liquid to Liquid Exchanger. Special liquid to liquid exchanger for counter current flow, six pass on both shell and tube sides. Most efficient design for crossing temperature conditions. Straight tubes easily cleaned.

DAVIS ENGINEERING CORPORATION
1066 EAST GRAND STREET, ELIZABETH 4, NEW JERSEY

SINCE 1915
Paracoil
HEAT TRANSFER EQUIPMENT

THIS UNIT WILL BE *READY* FOR *QUICK* INSTALLATION





The strongest argument for shop-fabricated power piping is that it is delivered on the job *ready for quick installation.*

Units come to the job when needed, saving storage and handling costs. Connections are made easily, accurately and quickly. Alignments are true and much guess work is avoided. Attendant shut-downs and waiting in related installations, are reduced to a minimum. Quick installation speeds construction—saves time and money.

Long experience, able technicians and a wealth of facilities give to Blaw-Knox a special fitness for furnishing power piping ready for quick installation.

These two books constitute a service offered by Power Piping Division. They are written by engineers and will be sent free to any engineer or major executive requesting them on his own stationery. Ask for the FLEX-ANAL Chart Book and Catalogue No. 1863.

Seven Blaw-Knox plants have been awarded the Army-Navy "E", and have regularly received renewal stars for continued high achievement in the production of war material.

BLAW-KNOX COMPANY
POWER PIPING DIVISION

1525 PENNSYLVANIA AVE.
N. S., PITTSBURGH, PENNA.

BEGINNING OF THE

"BIG DITCH"

. . . also marked the start of TOLEDO Leadership in Pipe Tools!

● It was a big forward step in 1902 . . . when our country bought the rights and franchises for the Panama Canal from France. This greatly strengthened our growing leadership in world commerce and world affairs.

It was also in that same year—44 years ago—that a new name in Pipe Tools was born. With a modest start in small factory quarters . . . this was the beginning of TOLEDO Leadership as producers of Pipe Tools of outstanding Accuracy and Quality.

Through the years . . . the name TOLEDO has been a familiar symbol of dependability and long-life economy among pipe mechanics in all fields. It's the name you can trust today *and tomorrow!* The Toledo Pipe Threading Machine Company, Toledo, Ohio. New York Office, No. 2 Rector Street Building.

The first TOLEDO Catalog published in August 1902 was 12 pages size 3" x 6" showing 4 tools —Models 1, 1A, 2 and 3. Our catalog today requires 60 pages size 8½" x 11" to describe the many models in the complete Toledo line.

TOLEDO

PRECISION PIPE TOOLS

"TOLEDO"

I AM A SAFETY HEAD

My Job Is-- PROTECTION

I stand watch over those pressure vessels that are full of energy and power . . . waiting to "go places." My job is to protect your plant, your equipment and your employees from explosions as a result of over-pressure. That's why the largest industrial plants in the country now use B.S.&B. SAFETY HEADS on *all kinds of pressure vessels.*

I Protect the "WORK HORSES" TOO!

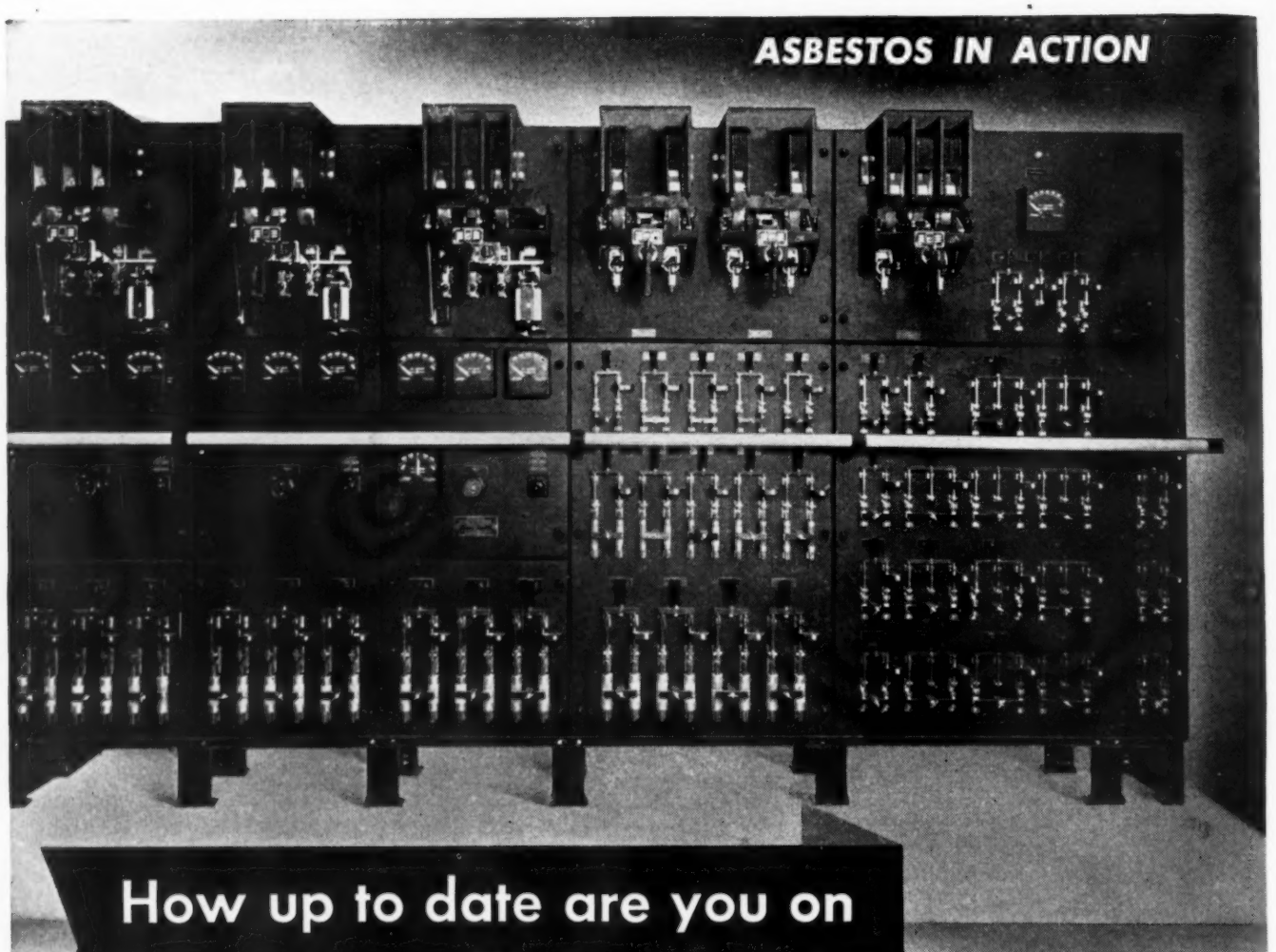
You may have SAFETY HEADS on chemical reaction equipment in your plant—but do not overlook the "work horses" . . . refrigeration and air conditioning equipment needs protection . . . compressed air lines are a constant danger point . . . hot water tanks are packed with energy. There are special types of B.S.&B. SAFETY HEADS for every kind of "work horse" in your plant and we'll be glad to tell you about them.

. . . WRITE FOR CATALOG

PRODUCTS B S & B SERVICE

BLACK, SIVALLS & BRYSON, Inc.

- **SALES OFFICES-- 24th FLOOR POWER AND LIGHT BUILDING, KANSAS CITY 6, MO.**
- **PLANT-- 7500 EAST 12th STREET, KANSAS CITY 3, MISSOURI**



How up to date are you on electrical panelling materials?

What about the panels, switchboards, bus bar runs, and other electrical apparatus mountings in your plant? Are they proof against absorption of moisture and oil? Do they stand up under high voltage surges, vibrations, and temperature changes, retain a business-like appearance without costly maintenance?

You can answer "yes" to all those questions if your electrical apparatus is mounted on K&M Ebonized Asbestos, the *modern* panelling material. Fabricators who work it and plants that use it say Ebonized Asbestos is ideal for the purpose.

Made of tough asbestos fibres, cement and an insulating compound, K&M Ebonized is moulded into strong monolithic sheets with exceptionally high dielectric strength. It gives extra-long service, in fact it grows tougher with age. Meets the requirements of Underwriters' Laboratories, Inc., when built into an assembled unit. Write us for full technical data on this superior mounting material.

Photograph courtesy I.T.E. Circuit Breaker Co.

Nature made Asbestos...

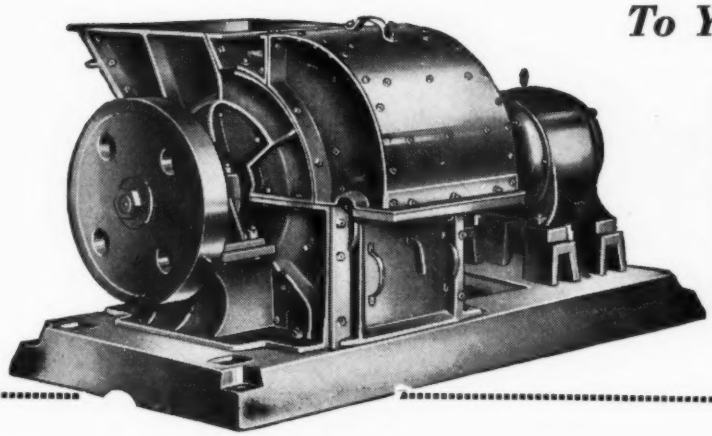
Keasbey & Mattison has been making it serve mankind since 1873

K&M best in asbestos

KEASBEY & MATTISON
COMPANY • AMBLER • PENNSYLVANIA

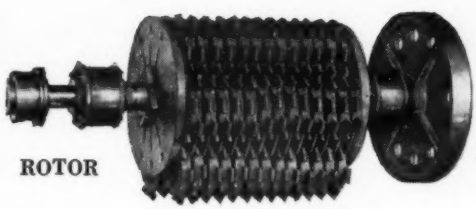
Your combustion efficiency can be no better than YOUR COAL PREPARATION..

American Rolling Crushers Assure A Uniform Product Controlled To Your Firing Requirements



Properly prepared coal permits more efficient firing. Uniformly crushed coal allows more adequate oxygen passage through fire bed decreasing excessive CO_2, minimizing clinkering and providing a quicker firing response to sudden steam demands. Uniformly sized coal also reduces ash pit drop.

Americans are built to rapidly and efficiently crush ROM or lump coal to uniform stoker or pulverizer size with a controlled minimum or maximum of fines and no oversize.

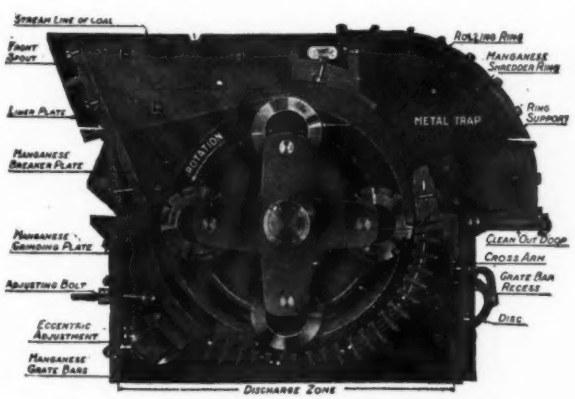


ROTOR

The rotor of Americans is equipped with multiples of shredder rings, each with 20 cutting edges for rapid impact splitting instead of crushing of coal which results in uniform sizing. The rings swing free on their own shafts and deflect from tramp metal, eliminating shear pins and other conventional safety devices.

SHREDDER RING

SOLID RING



Cross-section view of American Ring Crusher

A LOW - COST, COMPACT COMPLETE CRUSHING UNIT

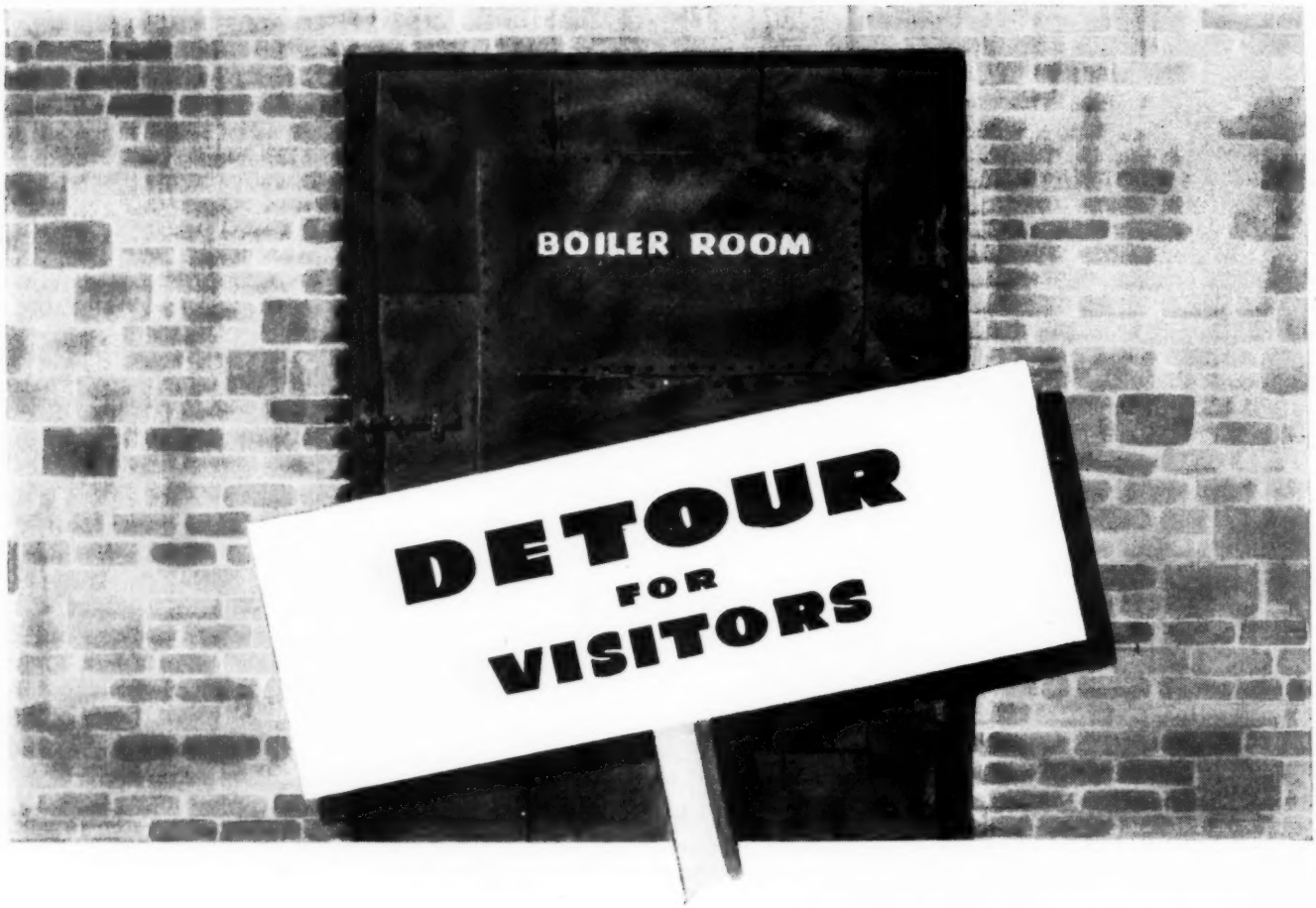
The American "S" Series Crusher is a compact, complete crushing unit easily installed in minimum headroom and requires no auxiliary breaker or special labor for efficient, high tonnage coal preparation. This complete American crushing unit creates no refuse problem or prolonged cleanout shutdowns. The operating cost of Americans is less than 1¢ a ton. Cross-section view of American Crusher illustrated at left, shows its compact construction. Built in 9 different sizes in capacities from 25 to 500 TPH.

SEND FOR BULLETIN "CRUSHING COAL AT LESS THAN 1¢ PER TON."

American PULVERIZER COMPANY

Originators and Manufacturers of Ring Crushers and Pulverizers

1349 Macklind Ave.
St. Louis 10, Mo.

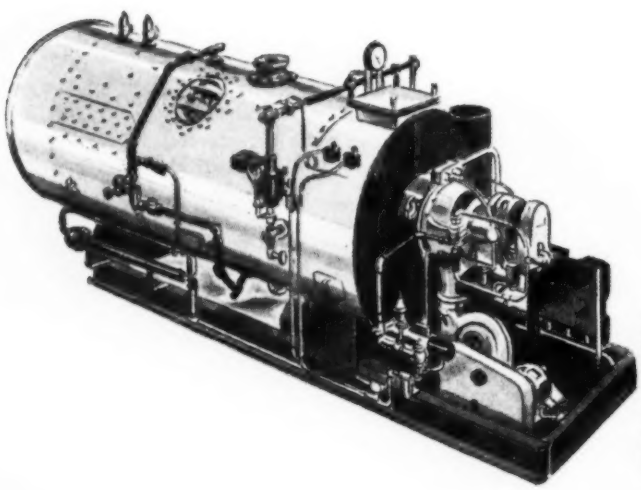


Ashamed of Your Boiler Room?

IS your boiler-room taboo for visitors? Are its appearance and condition such that you are not proud to say it's part of your plant or building?

There is a quick, sure remedy for an "eye-sore" boiler-room—replace your old steam plant with a modern, oil-fired Cleaver-Brooks steam generator. Its modern design and construction—its clean, smokeless, efficient operation (no ashes, dirt, or soot to contend with) assure a "show-place" boiler-room at all times.

CLEAVER-BROOKS CO., 332 E. Keefe Ave., Milwaukee 12, Wis.

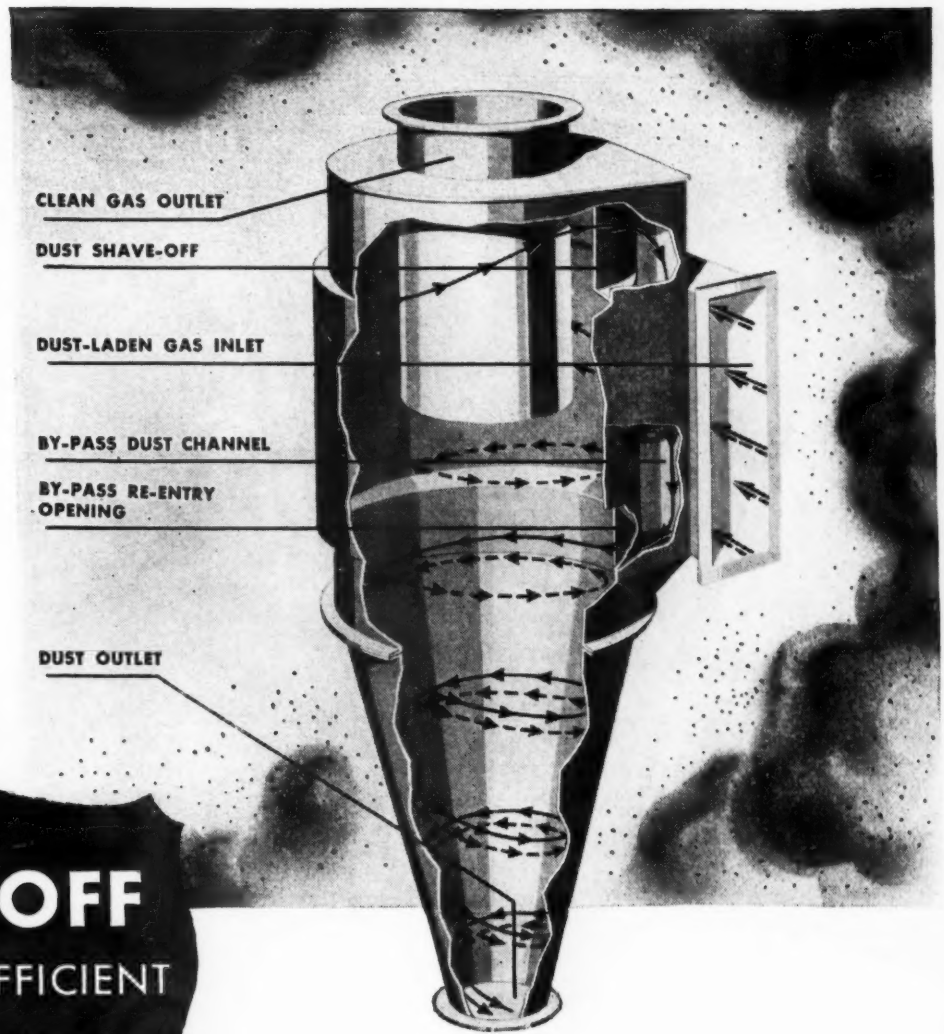


A custom-planned, application-engineered Cleaver-Brooks Steam Generator installation has made lower fuel and steam costs a reality in scores of plants. Here are some of the reasons:

- A steam plant tailored for your job. Cleaver-Brooks analyzes your load conditions, space and equipment arrangements, future growth needs, puts unit into initial operation, instructs as to operation, care, maintenance.
- Designed for utmost convenience of operator—all controls may be operated from front of boiler. A factory engineer puts unit into initial operation, and trains your employees in operation, care, maintenance.
- One source and one responsibility for the complete generator—Cleaver-Brooks factory-finished and tested—a fully "packaged" unit meeting all code requirements.
- Fast installation. No special foundation needed. Within 24 hours after arrival, your Cleaver-Brooks Steam Generator can be in operation.
- No smoke-stack required; simple roof-high vent exhausts combustion gases.
- Saves space, uses less plant area, fits into low head-room locations.
- Oil-firing eliminates smoke, ashes, clinkers, messy boiler-room conditions.
- Low operating costs; unsurpassed guarantee: — 80% thermal efficiency; 13% CO_2 gases; stack temperature not to exceed 125° F. above standard steam temperature.
- Quick steaming—for any emergency or fluctuating loads—through high heat transfer with Cleaver-Brooks 4-pass down-draft construction and integral oil-burner.
- Full-size range is available—22 models in sizes from 15 to 500 h.p., at steam pressures from 15 to 200 lbs. p.s.i. Write for bulletin and complete information.

Cleaver-Brooks
STEAM GENERATORS

WRITE on your business letterhead for the Free Steam Cost-Calculator — a ready-reference slide rule showing the comparative steam costs when using oil or coal as fuel.



THE SHAVE-OFF
ITS PLACE IN EFFICIENT *Dust recovery*

Six exclusive Buell features

1. THE "SHAVE-OFF"
2. LARGE DIAMETERS
3. EXTRA-STURDY CONSTRUCTION
4. CORRECT HOPPER DESIGN
5. SPLIT-DUCT MANIFOLDING
6. INNER WELDS GROUND SMOOTH

Under the principles of dust collection established by van Tongeren, the patented "shave-off," found only in Buell Dust Recovery Systems, increases dust recovery by utilizing the double eddy current (present in all cyclone-type collectors) to establish *a highly efficient collection force.* (See pp. 5-9 in Buell's book: "The van Tongeren System of Industrial Dust Recovery.")

The "shave-off" thus enables Buell to achieve high recovery efficiency without resort to small-diameter cyclones—and Buell's large diameters permit construction of extra-thick steel, efficient operation with low centrifugal force fields, and consequent reduction of abrasive wear. These are major reasons why Buell Dust Recovery Systems in use three, four, five or more years have established outstanding records for trouble-free service and low maintenance cost.

Buell's book—"The van Tongeren System of Industrial Dust Recovery"—illustrates and explains the patented van Tongeren principle and its many applications to industry. We will be pleased to send you a copy without charge.

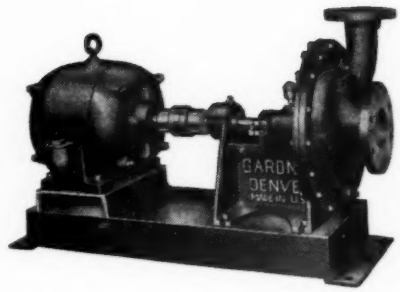
BUELL ENGINEERING COMPANY, INC.
10 Cedar Street, New York 5, N. Y.
Sales Representatives in Principal Cities

buell
DUST RECOVERY SYSTEMS

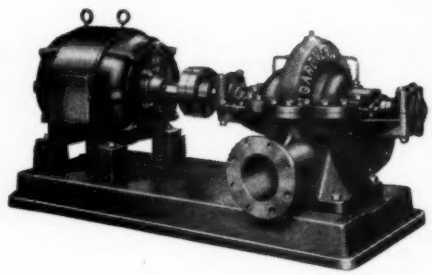
In the *Higher Efficiency* Brackets...

The smoothness and evenness with which water flows through your pump has a lot to do with pumping costs. In Gardner-Denver centrifugals, rigidly controlled foundry practices assure absolutely smooth water passages. Furthermore, these passages are properly proportioned to eliminate unnecessary eddies, back-waters and sudden changes in velocity. This—plus the inclusion of every other worthwhile hydraulic and mechanical feature—is why Gardner-Denver centrifugals are in the higher efficiency brackets. For complete information, write Gardner-Denver Company, Quincy, Illinois.

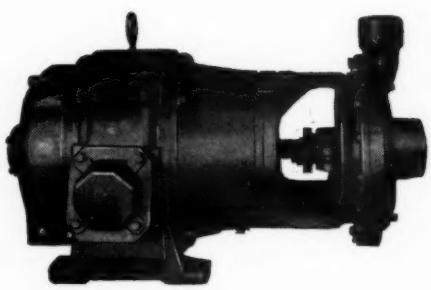
GARDNER-DENVER
Since 1859



Side Suction. *Designed for general service, these Gardner-Denver Side Suction Pumps are low in first cost, as well as in installation costs. Capacities up to 2.3 million gallons per day, or 1600 gallons per minute, can be handled in heads up to 100 feet.*



Double Suction. *Gardner-Denver Double Suction Single-Stage Centrifugal Pumps cover all heads up to 300 feet. These pumps have a horizontally split case for easy accessibility. Wearing rings are easily checked. The entire rotor assembly can be removed without disturbing the motor or piping, or exposing the bearings.*



Close Coupled. *In these Gardner-Denver Centrifugals, pump and motor are combined to form a complete, compact unit. Pumps can be installed in any position—on floor, wall or ceiling. These centrifugals are designed for capacities up to 250 gallons per minute, and heads up to 250 feet.*

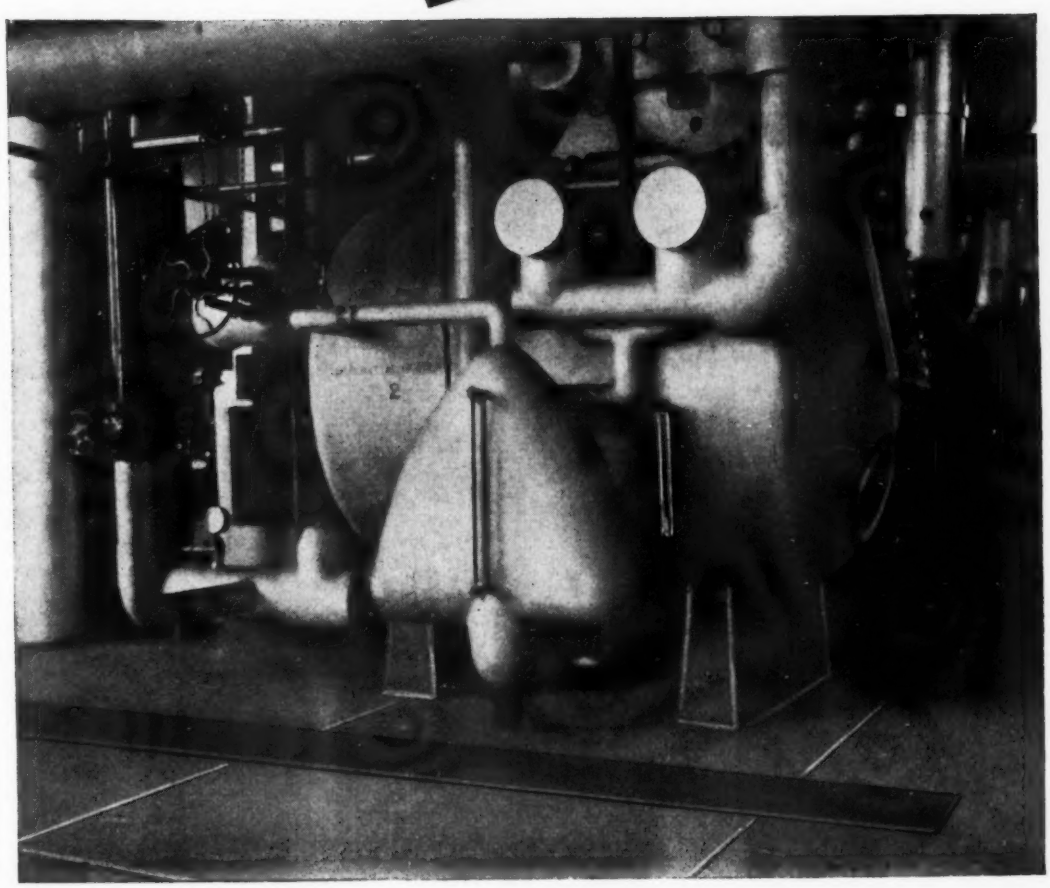
Water Conditioning at a LARGE WESTERN COAL COMPANY

An interesting example of boiler plant water conditioning is the Cochrane installation illustrated here. Shown in the upper photograph is the sedimentation tank of the Cochrane Hot-Process Softener of 16,000 GPH capacity installed outside the building. The lower photograph shows the Cochrane rolled plate Deaerator of 150,000 lbs./hr. capacity mounted on a rolled plate storage tank. Two Cochrane filters and chemical tanks supplement this equipment and are in addition to identical equipment installed in 1936.

The performance of Cochrane Water Conditioning Equipment in industrial applications over the past three-quarters of a century and the reputation of Cochrane engineering in the field of water conditioning are responsible for the continued preference for Cochrane. This experience and knowledge continues unchanged in the organization that is ready to solve your water conditioning problems today. Write for any information you may require along these lines.

COCHRANE CORPORATION
3106 NORTH 17th STREET • PHILADELPHIA 32, PA.

COCHRANE
SINCE 1863



(Above) Sedimentation tank of 16,000 GPH installed outside building.

(Right) Cochrane Deaerator of 150,000 lbs./hr. mounted on rolled steel plate storage tank.

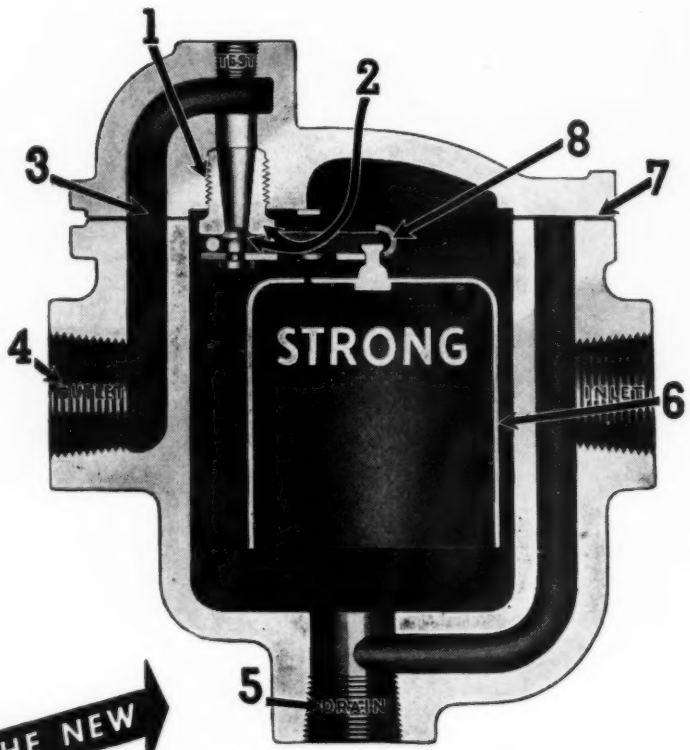
Eight Improvements

GENUINE STRONG make 70 Series Traps Better than Ever!

Look at these new features:

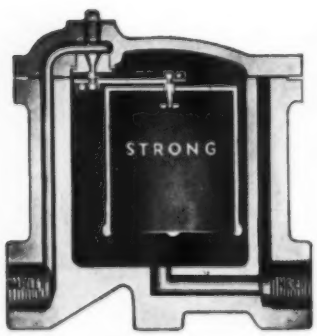
1. Renewable seat replacing pressed-in design;
2. Anum-Metl* valve and seat with new scientifically designed Hi-Cap* (patent applied for) orifice . . . up to 25% greater capacity;
3. Oversize inlet and outlet ports—increased flow capacity;
4. Relocated inlet and outlet connections—avoids backflow on light loads;
5. Drain connection added—available for bottom inlet;
6. One-piece, deep-drawn, stainless bucket—no welds;
7. Larger gasket area—means positive seal;
8. New, improved, stainless, high-ratio leverage.

Plus Adaptability to older models with change-over assembly including Hi-Cap orifice.



New 70 Series Strong Trap, No. 170

COMPARE THE NEW WITH THE OLD



Old 70 Series Strong Trap

In improving the 70 Series trap, Strong has remembered the thousands of older style 70 Series traps still in service after many years. Each improvement bears the "proof in service" label, so Strong quality remains uniformly high. Service continues to be available on all Strong traps, and they can be completely modernized to include the improvements listed above.

With a complete line of Strong open and inverted bucket traps at their disposal, Strong engineers can specify exactly the right type of trap for your particular application. For full details, write for the new Strong Catalog No. 67.

STRONG, CARLISLE & HAMMOND COMPANY, Cleveland 13, Ohio

*Registered Trade Mark

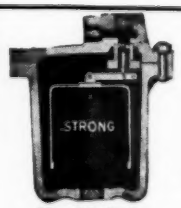
REG. TRADE MARK

OTHER ANUM-METL Reg. Trade Mark

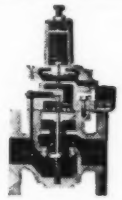
STRONG

STEAM SPECIALTIES

Strainer



No. 80 Series Trap



Reducing Valve

"BUT YOU FORGOT TO PUT ASBESTOS BETWEEN SOME OF THE SPIRALS"

INTENTIONAL "FORGETTING" THAT HAS SOLVED COUNTLESS PROBLEMS NO OTHER GASKET COULD SOLVE

Compare Flexitallic Gasket Structures closely with ordinary spiral-wound gaskets and you will notice a small, patented physical difference which makes a tremendous difference in performance. Only in Flexitallic — *the original* — spiral-wound gaskets will you find metal-on-metal windings at strategic points of the cross-section without intervening filler material. The extent and position of this reinforcement is scientifically determined for each application. Only in this way is it possible to provide maximum strength and balance with minimum seating area. And only by the exclusive Flexitallic design feature of adapting this principle to form a metal-to-metal wall at specific locations can the all-essential balance of gasket flow factors to joint stresses be obtained. Leakage and joint failure are prevented — even under the most rigorous conditions. . . . Write for catalog and gasket application data.

FLEXITALLIC GASKET COMPANY
8th & BAILEY STREETS, CAMDEN, NEW JERSEY

"Flexitallic"
REG. U. S. PAT. OFFICE

HEAT-PROOF • PRESSURE-PROOF • SHOCK-PROOF • LEAK-PROOF

TAKE A LOOK at what CLARAGE offers in UNIT HEATERS!

Square Outlets
Easily removable and adjustable for four directions of heat discharge.

V-Belt Drive
Insures quieter operation and greater flexibility of fan speed. (Direct connected units can be furnished.)

Centrifugal Fans
One for each heater outlet. Pressure type fans delivering heat over wide areas.

Syncrotherm Control
Regulates temperatures by controlling with by-pass dampers amounts of air passing through and around heating coil. Can be automatically or manually operated.

Readily Accessible
Front or back section of casing quickly removable. All working parts completely accessible.

Front section of casing, fan housings and coil removed.

Use UNITHERMS
To Cut Your Factory Heating Costs

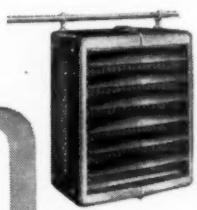
With Clarage Unit Heaters you get plenty of heat — where you want it — when you want it!

And thanks to our exclusive feature — *Syncrotherm Control* — Clarage Unitherms maintain uniform temperatures with relatively LOW TEMPERATURE AIR — fuel savings substantial.

Built for floor or ceiling installation in a liberal range of sizes, operating on steam or hot water.

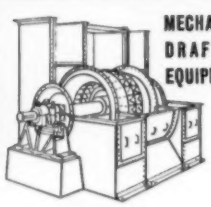
. . . And for Smaller Jobs

Clarco Unit Heaters (shown at right) are for small space heating, or to "help out" present equipment. Quiet in operation — ideal for offices and stores as well as factory service. Wide range of sizes, using steam or hot water.

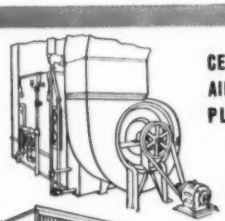


Sorry, but the large volume of orders already accepted prevents deliveries for 1946 heating season. We would, however, appreciate an opportunity to figure your future requirements.

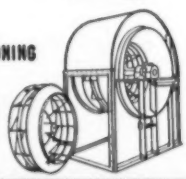
SOME OF OUR OTHER PRODUCTS



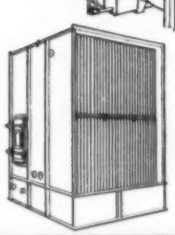
MECHANICAL DRAFT EQUIPMENT



CENTRAL STATION AIR CONDITIONING PLANTS



AIR CONDITIONING AND VENTILATING FANS



AIR WASHERS

CLARAGE
FAN COMPANY
Kalamazoo, Michigan

APPLICATION ENGINEERING OFFICES IN ALL PRINCIPAL CITIES

No wear! No slips! No deadlines missed!

DAYTON V-BELTS

absorb shocks...eliminate slippage

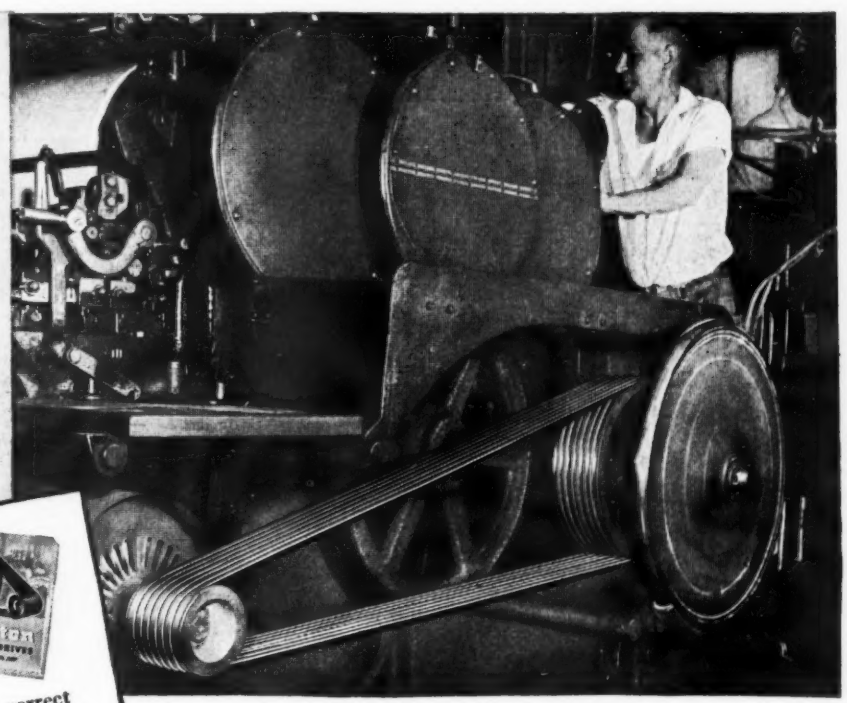
PROVIDE POSITIVE POWER TRANSMISSION

Original belts on the two-color presses of one of the country's largest printing plants started and stopped the presses with an abrupt shock . . . slipped frequently, causing uneven operation. Result was excessive wear on press parts and motor armature, requiring frequent repair. Moreover, belts broke frequently, causing complete shutdowns, loss of production and sometimes missed deadlines. Troubled, management tried Dayton V-Belts. Now power is delivered evenly, presses start and stop smoothly, belt slippage has been eliminated . . . maintenance costs have been reduced . . . production has been stepped up. Dayton V-Belts transmit power smoothly and positively because the *engineered* resilience of Dayton V-Belts, and the seating action of the belts in the pulley grooves, absorb the shocks of suddenly applied power. Their scientific design and construction is the result of over 40 years of research and manufacturing experience working with natural and synthetic rubber. It is experience that can help you solve your power transmission drive problems. For full information write The Dayton Rubber Manufacturing Company, Dayton 1, Ohio.

ATTENTION

POWER TRANSMISSION ENGINEERS:

There is a mill supply house near you that stocks Dayton V-Belts. A representative will gladly discuss your power transmission drive problems with you. Look for the name under the trade name heading "Dayton V-Belts" in the yellow pages of your telephone book.



WRITE TODAY FOR YOUR DAYTON CATALOG:

The Dayton No. 280 catalog contains 384 pages of tables and data that make selecting the correct V-Belt Drive quick and easy. Write for your copy today. It's free.

THE DAYTON RUBBER MANUFACTURING CO.
DAYTON 1, OHIO

Dayton Rubber
REG. TRADE MARK THE DAYTON RUBBER MFG. CO.
THE MARK OF TECHNICAL EXCELLENCE IN SYNTHETIC RUBBER

THE WORLD'S LARGEST MANUFACTURER OF V-BELTS

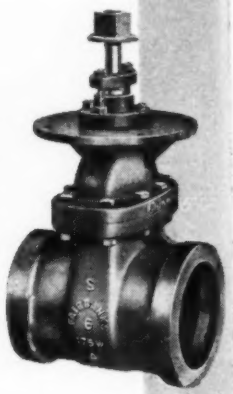
If you pipe it...there's a **fairbanks valve** to control it

Here are five typical examples of the outstanding design, sound engineering and rugged construction that are built into every Fairbanks Valve. Years of experience in meeting all kinds of valve requirements for industry, have given Fairbanks Engineers a storehouse of knowledge in controlling the flow of water, steam, gas, oil, chemicals, etc. Consult them without obligation. Just write or call The Fairbanks Company, 393 Lafayette St., New York 3, N. Y.; 520 Atlantic Ave., Boston 10, Mass.; 15 Ferry St., Pittsburgh 22, Pa.; 748 M & M Bldg., Houston 2, Texas.

American industry flows through **fairbanks valves**

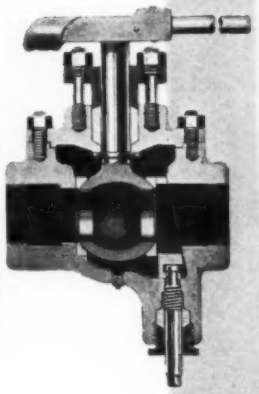
HUB END GATE VALVE
(Fig. — 0431)

. . . 175 lbs. cold water working pressure — non-shock. A non-rising stem gate valve designed for use with Indicator Posts on lines below ground or floor level. Body of semi-steel with high tensile strength, reinforced at all points of strain. Stem of heavy bronze with Acme threads for additional lifting strength and ease of operation. All parts in contact with stem are bronze or bronze lined to prevent corrosion, reduce friction. Sizes 4" through 14".



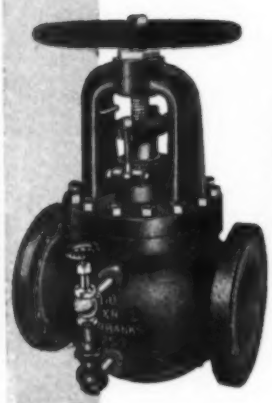
IMPROVED "SPHERO" BALL VALVES
(Fig. — 0850)

. . . 250 lbs. steam working pressure; 500 lbs. cold water, oil or gas pressure — non-shock. A quick opening valve with full flow. ¼ turn fully controls valve. Eliminates all easily corroded, threaded parts in line of flow . . . offers less resistance to flow. Cleaning of working parts can be accomplished without removing valve from line. Sizes ½" through 8".



ASBESTOS PACKED COCK
(Fig. — 0805)

. . . 125 lbs. steam working pressure; 200 lbs. cold water, oil or gas pressure — non-shock. Grooved, asbestos packed plug cock for boiler blow-off service or controlling the flow of certain acids. Body plug and gland are semi-steel with great strength. Plug is barffed (protected against rust by a special process). Asbestos groove packing is vulcanized . . . provides a smooth, non-galling bearing for the plug. Sizes ⅛" through 6".

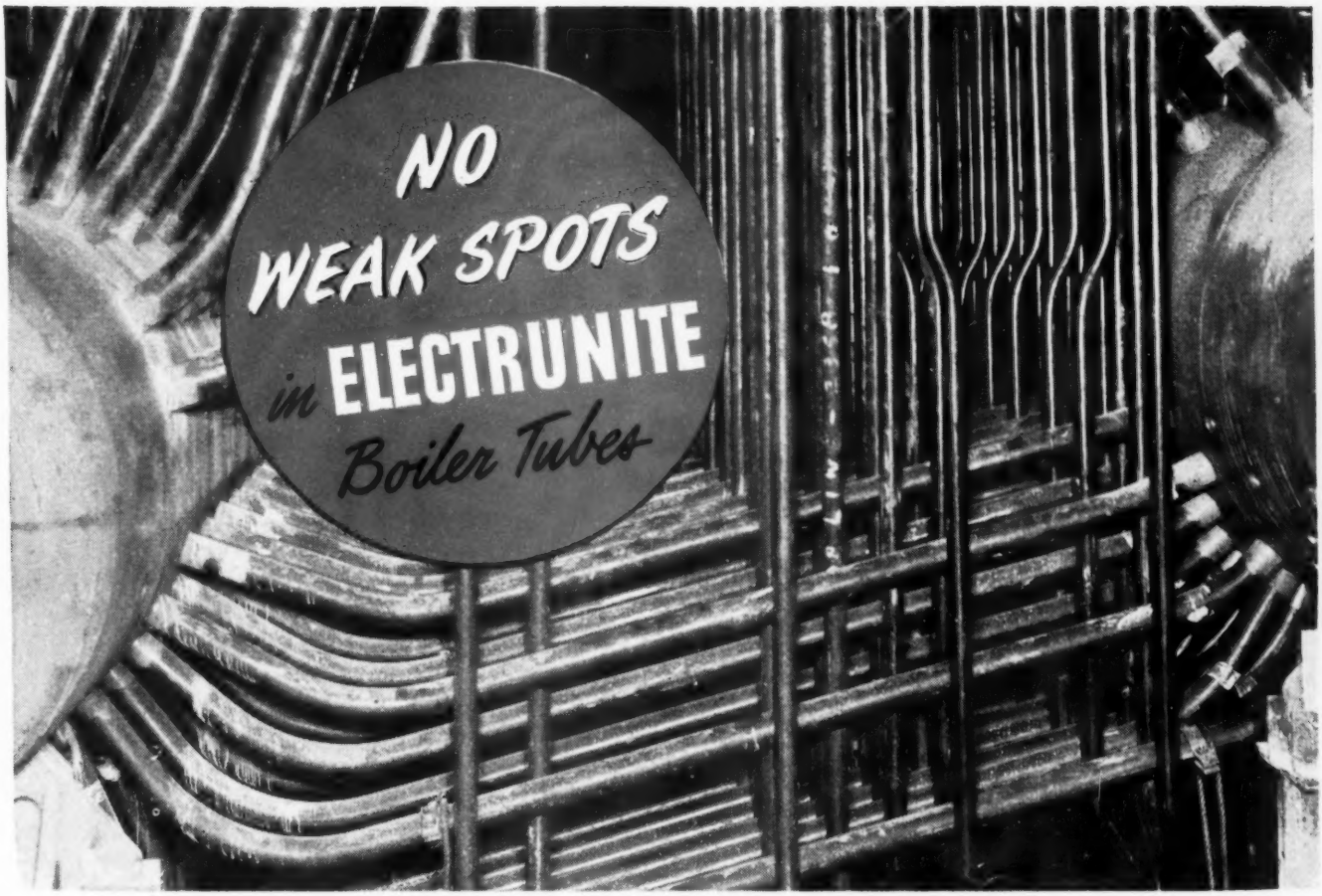


GLOBE VALVE
(Fig. — 0110)

. . . 250 lbs. steam working pressure; 500 lbs. cold water, oil or gas pressure — non-shock. Extremely rugged iron body, bronze mounted globe valve of the regrinding type. Has ample safety factor to withstand the stresses and strains of high pressure. Bronze stems with Acme threads are of generous proportions for strength and ease of operation. Without removing valve from line, seat and disc may be reground when necessary. Sizes 2" through 12".

IRON BODY GATE VALVE
(Fig. — 0405)

. . . 125 lbs. steam; 200 lbs. cold water, oil or gas (pressures vary with sizes). Designed for general service on steam, water, gas or oil where unobstructed full flow is desired. Strong construction with reinforcing where required to give extra strength, long, trouble-free life. Bronze mounted, outside screw and yoke, solid wedge, taper seat. Valves may be repacked under pressure when wide open. Sizes 2" through 24".



Here's why
1. INSPECTED INSIDE AND OUT
—no hidden defects
2. FLAT-ROLLED STEEL
—means uniform wall thickness
3. COLD-FORMED INTO TUBING
—assures freedom from scale
4. ELECTRIC RESISTANCE WELD
—proved 100% as strong as any point in the wall

You can't afford to take chances when specifying boiler tubes for your steam generating equipment. That, alone, is ample reason why it pays to insist upon Republic ELECTRUNITE Boiler Tubes—the tubes with uniform strength and uniform wall thickness . . . throughout every length . . . throughout every shipment.

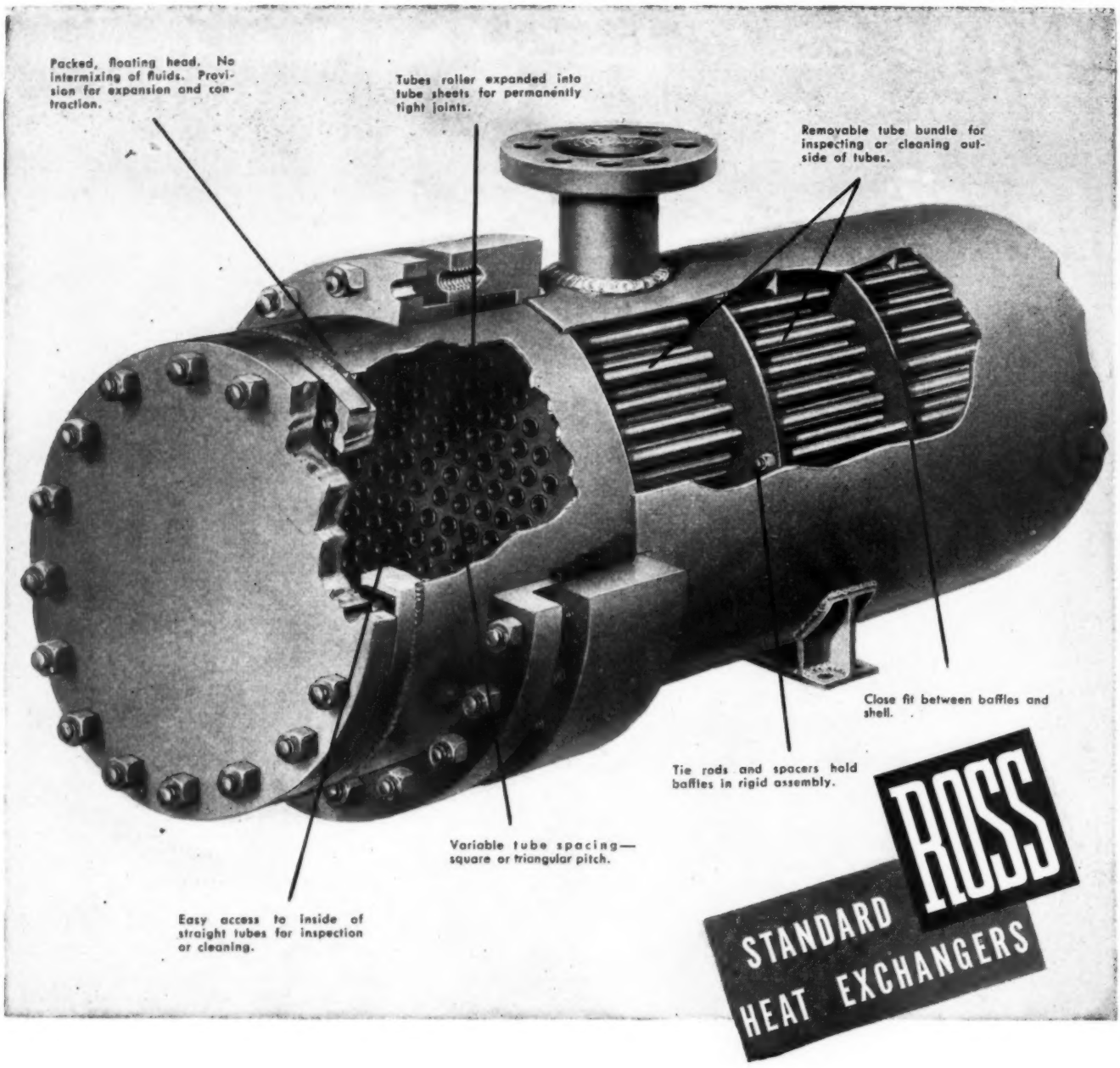
Such consistent uniformity is not brought about by accident. It is a direct result of the ELECTRUNITE Process of electric resistance welding, in which flat-rolled steel is cold-formed into strong, sound, scale-free boiler tubes.

Actual service records of more than 150,000,000 feet of ELECTRUNITE Pressure Tubes—installed in all types of stationary, railroad and marine boilers, and other steam generating and heat transfer equipment—prove conclusively that you can't beat these *modern* boiler tubes for ease of installation, trouble-free performance and dependable long life.

Complete information on request. Write to:

REPUBLIC STEEL CORPORATION
STEEL AND TUBES DIVISION • CLEVELAND 8, OHIO
Export Department: Chrysler Building, New York 17, New York

Republic
ELECTRUNITE
Reg. U. S. Pat. Off.
BOILER, CONDENSER AND HEAT EXCHANGER TUBES


Packed, floating head. No intermixing of fluids. Provision for expansion and contraction.
Tubes roller expanded into tube sheets for permanently tight joints.
Removable tube bundle for inspecting or cleaning outside of tubes.
Close fit between baffles and shell.
Tie rods and spacers hold baffles in rigid assembly.
Variable tube spacing—square or triangular pitch.
Easy access to inside of straight tubes for inspection or cleaning.
ROSS
STANDARD HEAT EXCHANGERS

Designed and constructed to cope with diversified temperatures, pressures and corrosive conditions

A broad range of requirements *can* be and *is* efficiently handled by the standardized line of Ross Heat Exchangers. To assure specified performance under your own operating conditions, there are five basic types in this line, each thermally designed for particular kinds of service.

Known as Series CHX, Ross Standard Heat Exchangers represent the finest in engineering, construction and materials, with full consideration to favorable initial investment, operating and maintenance costs. By reason of Ross standardization and mass production of individual heat exchanger parts, you benefit in both cost and improved quality.

Illustrated is one of these Ross standard types, featuring packed floating head, removable tube bundle, straight tubes and provision against intermixing of the two fluids circulated. For specific information on this design, as well as on the other standard types, consult a Ross Heat Exchange Engineer. He will gladly work with you to determine the unit best suited to your needs.

Ross Heater & Mfg. Co., Inc., 1415 West Ave., Buffalo 13, N. Y. Division of American Radiator & Standard Sanitary Corp. In Canada, Ross equipment is manufactured and sold by Horton Steel Works Ltd., Fort Erie, Ontario.

How's this for Taking Abuse!

ERN
UNION
JAN 29 1946
ZALLEA BROS. AND JOHNSON=
ATTN. MR. S. ZALLEA
WILMN DEL. =
LONG 3-3/4" INCH TRAVERSE FIVE CORRUGATION STAINLESS STEEL
JOINT EXTENDED MORE THAN 10 INCHES DUE TO SLIPPAGE OF ANCHOR
WHEN LINE WAS SUBJECTED TO 400 PSI. JOINT IS TIGHT. AND DID
NOT FAIL. CAN. JOINT BE RECOMPRESSED STRESS RELIEVED AND USED.
IF NOT WIRE BEST SHIPPING DATE AND PRICE OF DUPLICATE JOINT
USED ON STEAM SUPPLY TO UTILITY GAS TRANS MISSION COMPRESSOR=
OUR 2732 • 12 INCH DIAMETER 42 INCH
2732
WANT A REPLY?

THE Zallea Self-Equalizing Expansion Joint referred to in the above wire was installed in a 250 lb steam line. On test, 400 psi was applied, and, because of an error in calculation of required anchor strength, the main anchor on the blank end of the line "let go." Before the condition could be corrected the joint extended more than 10"—nearly 3 times its rated maximum traverse—*but it did not fail.*

No expansion joint was ever designed to withstand the abuse to which this one was subjected. But the quality we build into every type we produce makes them endure —even in the severest service.

Zallea Corrugated Expansion Joints are made in non-equalizing, self-equalizing and duo-equalizing types, depending upon the conditions under which they must operate . . . of copper, stainless steels and other corrosion-resistant alloys . . . diameters from 3" upward . . . traverses up to 7½" . . . for pressures from vacuum to 300 psi . . . for temperatures from sub-zero to 1600°F. Let us quote on your requirements.

"Code-Craft"...

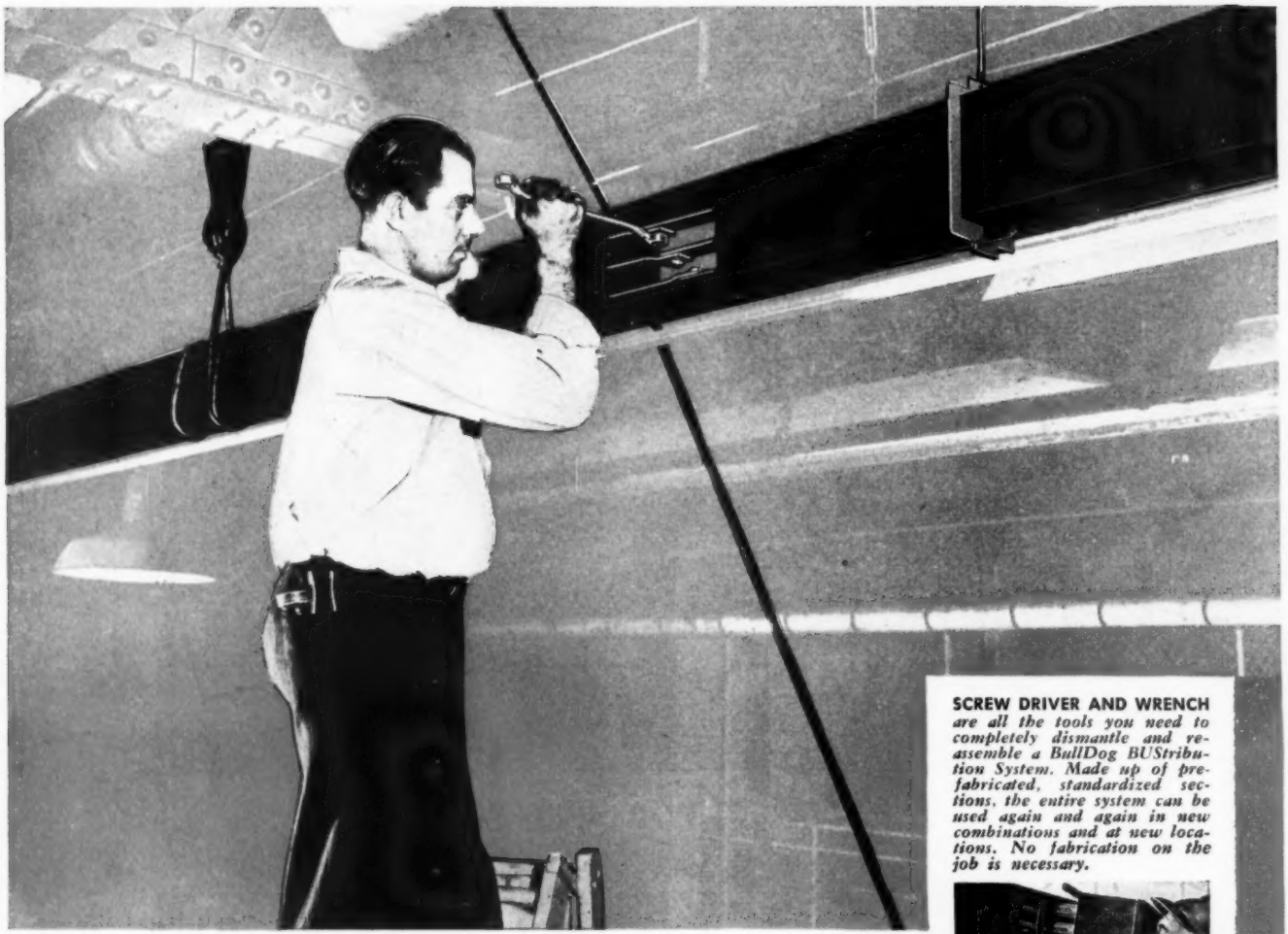
ZALLEA BROTHERS & JOHNSON

...EQUIPMENT FOR THE PROCESS INDUSTRIES

814 LOCUST ST. • WILMINGTON 99, DEL.

Specify and Demand ZALLEA *Furnace-Annealed* Expansion Joints

Power line relocated . . . all material salvaged



SCREW DRIVER AND WRENCH *are all the tools you need to completely dismantle and reassemble a BullDog BUStribution System. Made up of prefabricated, standardized sections, the entire system can be used again and again in new combinations and at new locations. No fabrication on the job is necessary.*

NO WAITING FOR POWER *with a BUStribution System—simply raise the plug to the nearest plug-in opening, snap its contact fingers over the busbar conductors and bolt the plug to the duct casing. The plug itself is a current protective device for the machine it serves.*

NO SCRAP WITH ANY MOVE! *There is no waste when you move a BullDog BUStribution System from one location to another. The component materials—steel duct, copper bus bars and vitreous porcelain—do not readily deteriorate and can be used indefinitely.*

Capacities: Feeder type—600 amps. to 4,000 amps.; Plug-in type—225 amps. to 1,350 amps.

You Can Do It With BullDog BUStribution DUCT

Manufacturers with an eye on tomorrow look to BullDog BUStribution DUCT for plug-in power supply, because this flexible bus duct system is *engineered for the future.*

"Moving day" in your plant can mean the time when your electrical system must be relocated, a new machine installed, or an old one shifted. In any case, BUStribution DUCT is ready for the change.

Built in standardized, prefabricated sections, it can be dismantled, moved and reassembled without scrapping a single nut or bolt. And when you shift a machine, the circuit protective plug moves right with it for easy mounting at the nearest plug-in opening. No cutting power . . . no tapping in "hot"—no lost production time.

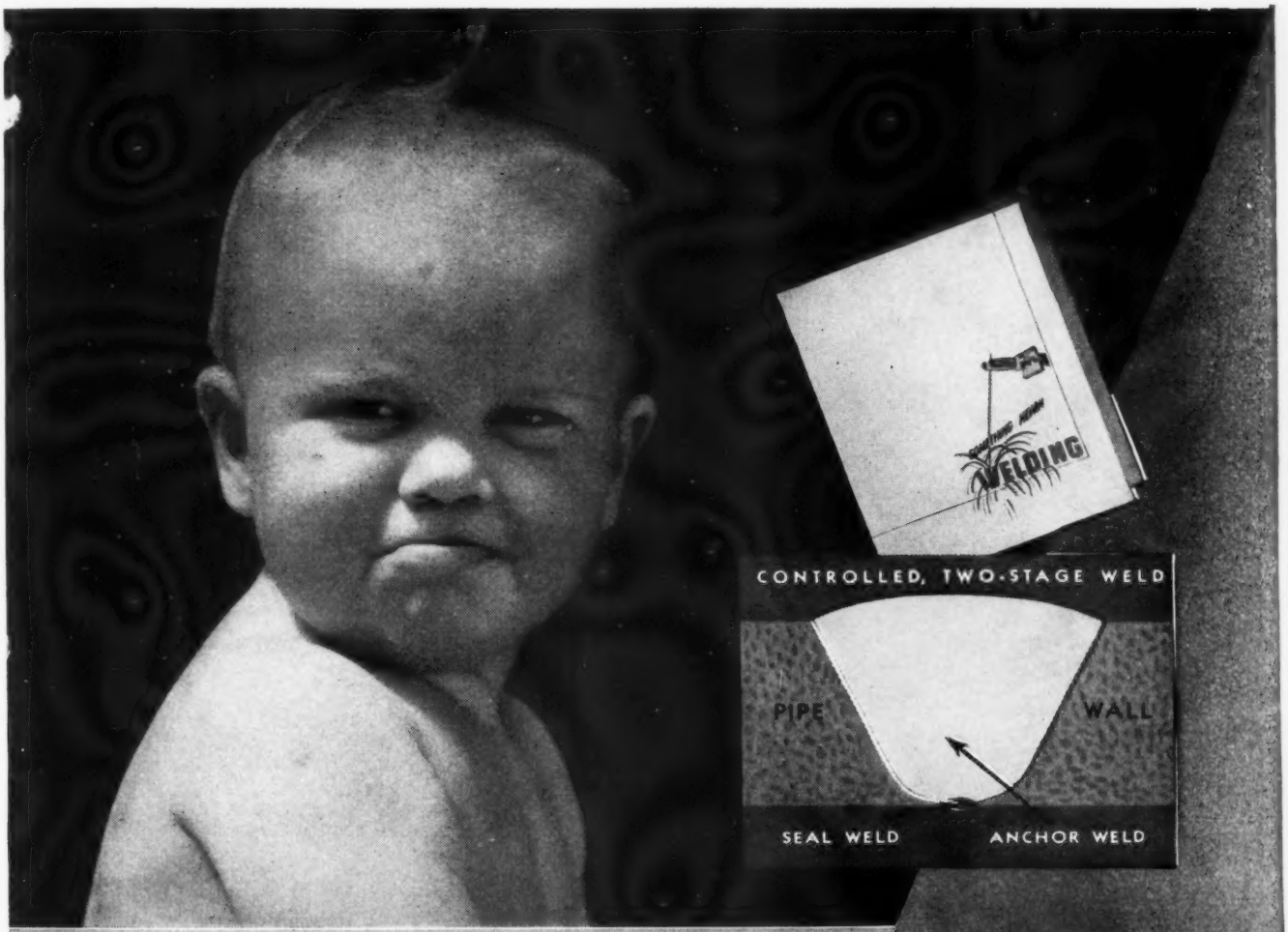
Write for detailed descriptive folders. Or, better still, consult a BullDog field engineer who can show you a BullDog installation near your own plant.

BullDog Also Manufactures Vacu-Break Safety Switches—SafToFuse Panelboards—Switchboards—Circuit Master Breakers—Industrial Trol-E-DUCT for Portable Tools, Cranes and Hoists—Universal Trol-E-DUCT for completely flexible lighting.

BULLDOG

ELECTRICAL DISTRIBUTION SYSTEMS

BULLDOG ELECTRIC PRODUCTS COMPANY, BOX 177, R. PK. ANNEX, DETROIT 32, MICHIGAN. In Canada: BullDog Electric Products, Ltd., Toronto. Field Engineering Offices in All Principal Cities



INSIDE OF BUTT WELDED JOINTS*
SMOOTH AS A BABY'S SKIN

If you ran your hand over the *inside* of a Westport Joint, you'd find it to be *smoother than the outside* of the neatest job of fusion, butt welded pipe you ever saw. This is because icicles of metal inside butt welded joints are eliminated, without resorting to the use of backing rings, which are perhaps the lesser of two evils. Westport Joints are made by a patented method of Controlled, Two-Stage Welding assuring "penetration without protrusion". They are especially advantageous in heavy wall piping for high pressure-temperature conditions. Our bulletin "Something New in Welding" tells the complete story. Write for it today. And remember, while our shop pre-fabricated piping can be made with any type of joint, we believe you'll prefer and specify the Westport, after you read our bulletin.

WESTPORT JOINT

*MADE WITHOUT BACKING RINGS BY THE MITCHELL-WESTPORT METHOD

(PATENTED)

W. K. MITCHELL & CO., INC.

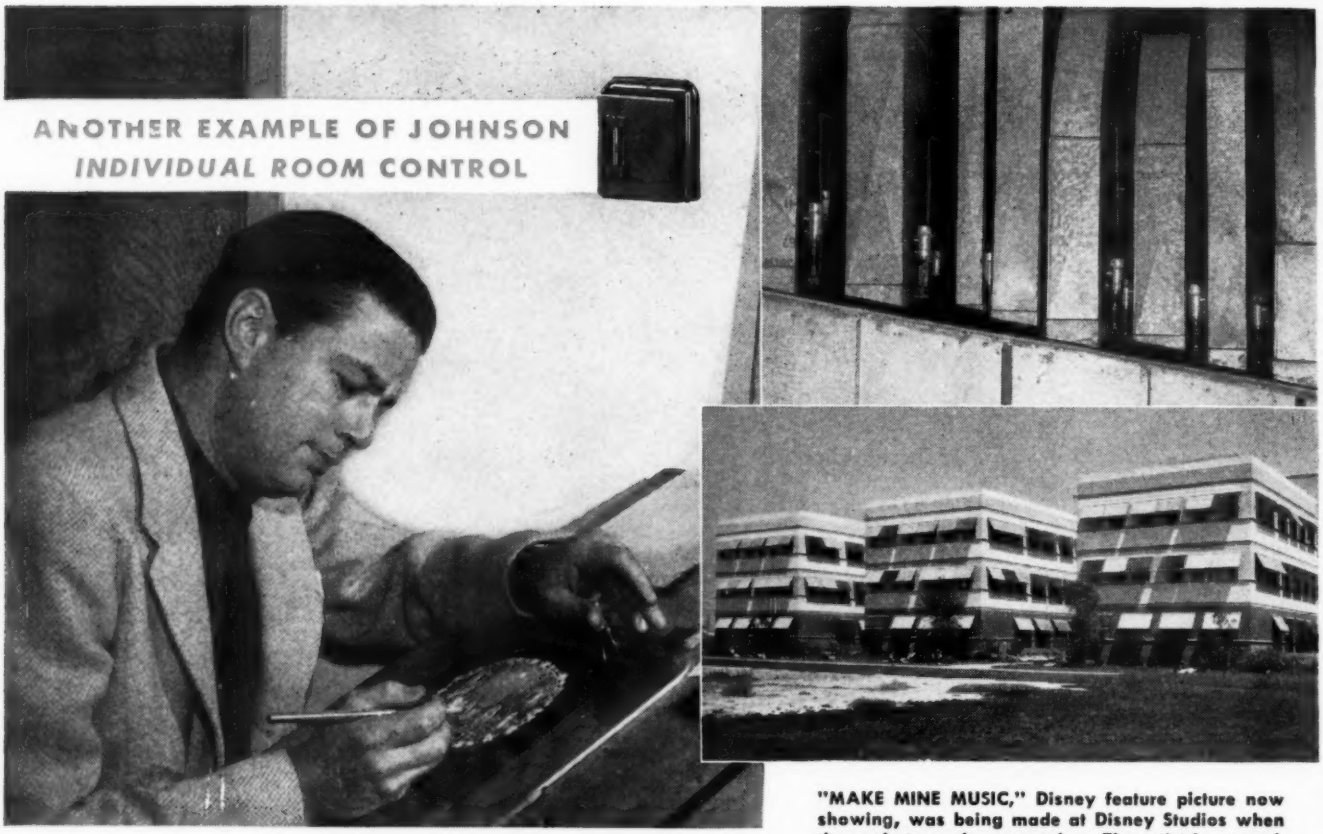
2944 ELLSWORTH STREET

PHILADELPHIA 46, PA.

SINCE 1899

MITCHELL

PIPING FABRICATORS AND CONTRACTORS



"MAKE MINE MUSIC," Disney feature picture now showing, was being made at Disney Studios when these photographs were taken. The artist is at work on the "Two Silhouettes" sequence... The air conditioning equipment is by General Electric Company.

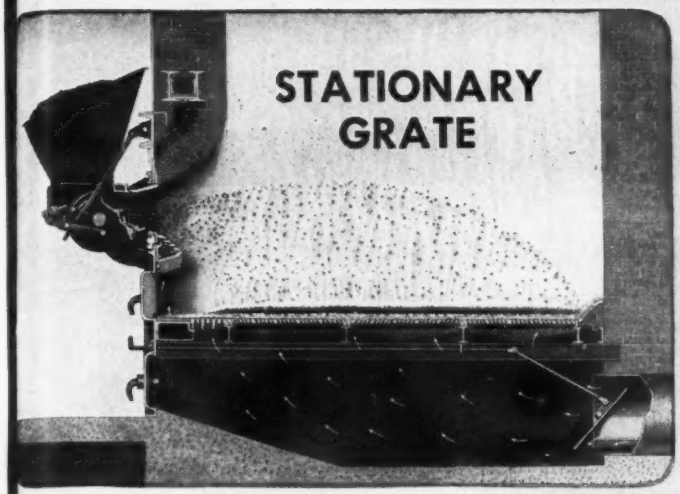
COMPLETE AIR CONDITIONING JOHNSON CONTROLLED IN THE ANIMATION BUILDING AT Disney STUDIOS

MORE THAN 150 Johnson room thermostats have controlled the air-conditioned temperature in each room, since the Animation Building at Disney Studios, Burbank, California, was completed in 1939. Other buildings on the Disney "lot" also are equipped with Johnson-controlled air conditioning systems... In the photograph of the artist at work, the Johnson room thermostat is "on watch," operating a Johnson mixing damper so as to deliver conditioned air to the room at exactly the required temperature. In the view at upper right, several ducts serving individual rooms are shown. In each of these there is a Johnson mixing damper, controlled by a long-travel, piston type Johnson damper operator, a number of which are visible on the sides of the ducts.

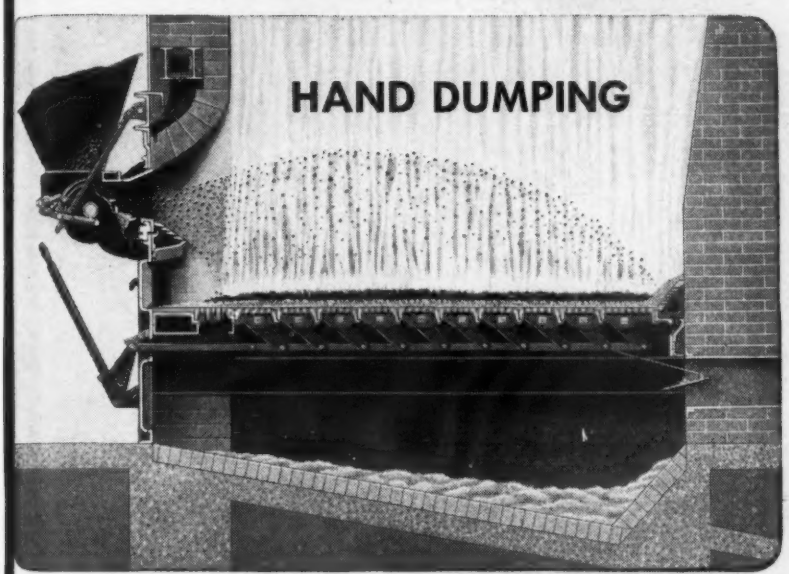
The room thermostats in each wing are adjusted automatically by an outdoor master thermostat, so that the temperature in each room is increased gradually from 75° to 78°, during the cooling season, as the outdoor temperature rises from 75° to 100°... Hundreds of Johnson thermostats, valves, dampers, and damper operators, with thousands of feet of copper tubing and countless auxiliary devices, were assigned to the important job of maintaining exactly correct conditions in the various stages, offices, studios, and laboratories in this great group of buildings. Many of the smaller buildings and projection rooms are incased completely in sound-proof walls, without exposure to outside temperatures, insuring complete elimination of noise. Ingenious arrangements of control apparatus insure accurate control of temperatures and humidities ... Ask a Johnson engineer, from a near-by branch office, to solve *your* next temperature control problem. Johnson Service Company, Milwaukee 2, Wisconsin. Direct Branch Offices in Principal Cities.

JOHNSON *Automatic Temperature and Air Conditioning* **CONTROL**

DESIGN · MANUFACTURE · INSTALLATION · SINCE 1885



A GREAT STOKER



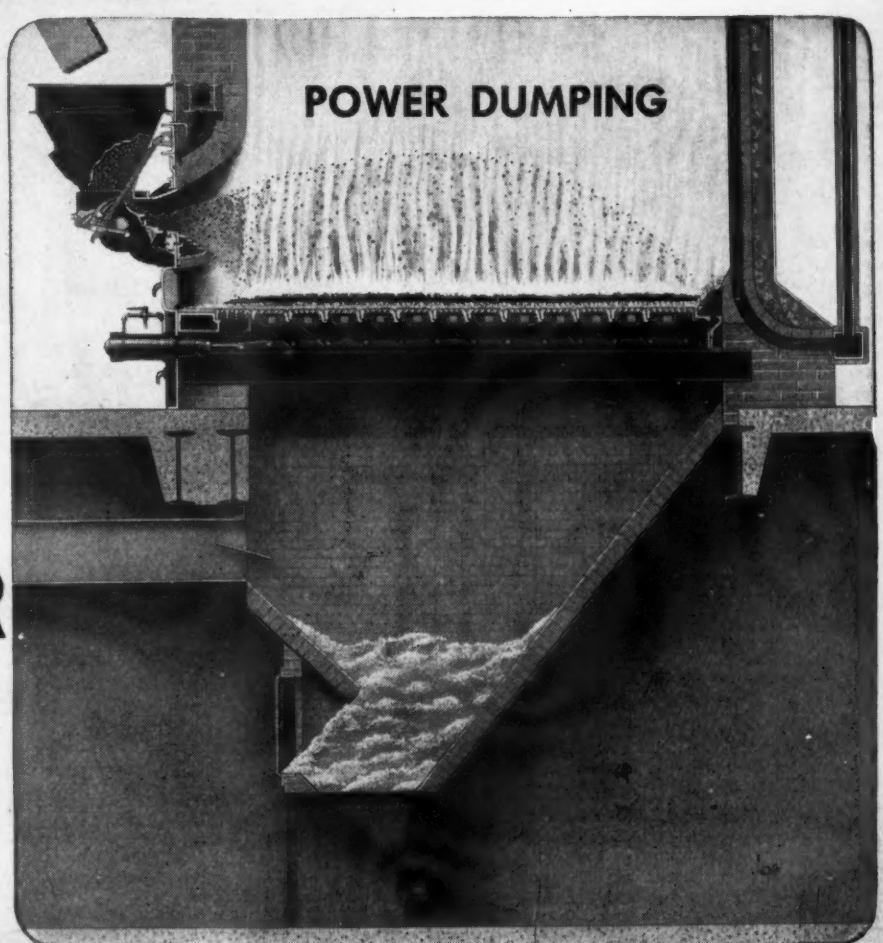
- OVERTHROW ROTORS ASSURE CONTINUOUS AND DEPENDABLE FUEL FEED AND UNIFORM DISTRIBUTION.
- BURNS ALL GRADES OF BITUMINOUS COAL WITHOUT SPECIAL PREPARATION.

DETROIT ROTOSTOKER

For SMALL to MEDIUM Size BOILERS

- STATIONARY
- HAND DUMPING
- POWER DUMPING

GRATES



DETROIT STOKER COMPANY

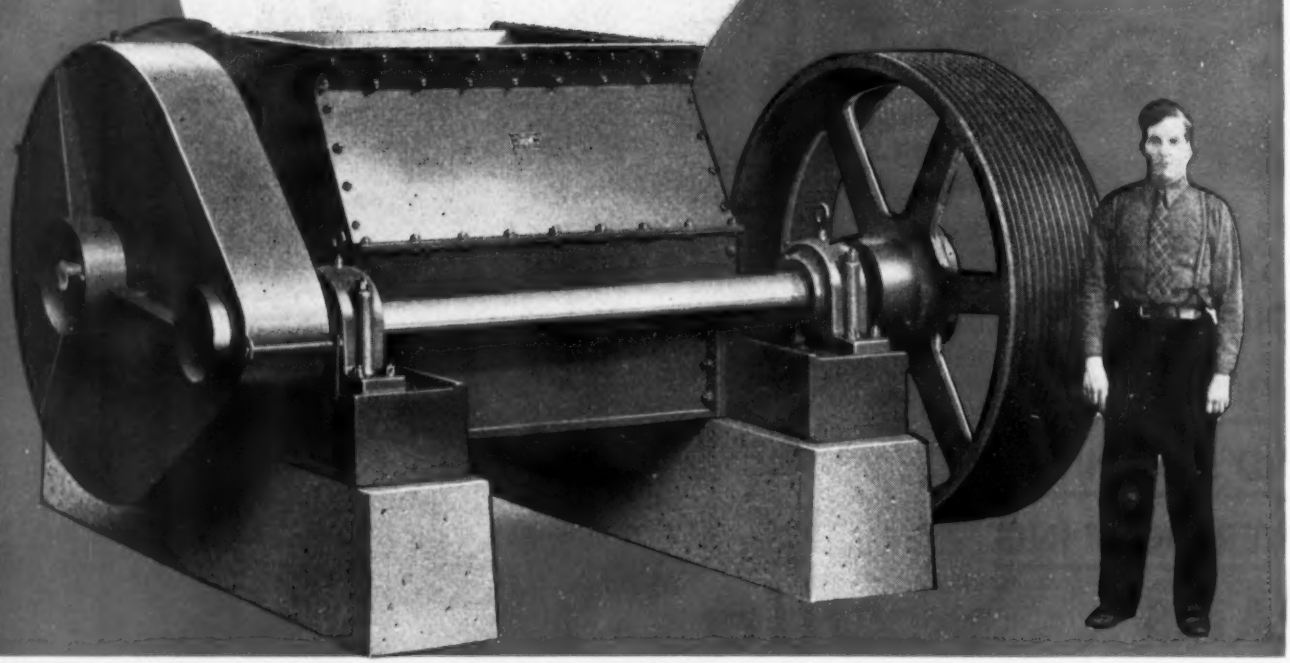
SALES and ENGINEERING OFFICES
GENERAL MOTORS BUILDING
DETROIT 2, MICHIGAN
WORKS AT MONROE, MICHIGAN

JEFFREY SINGLE ROLL CRUSHER

For Correct Sizing of Coal With a Minimum of Fines

Reduces run-of-mine coal from 8" down to 1½" and all intermediate sizes in a single operation. Can be furnished with interchangeable fine-crushing segments that will size stoker coal down to 90% minus 1".

Send for Catalog 778

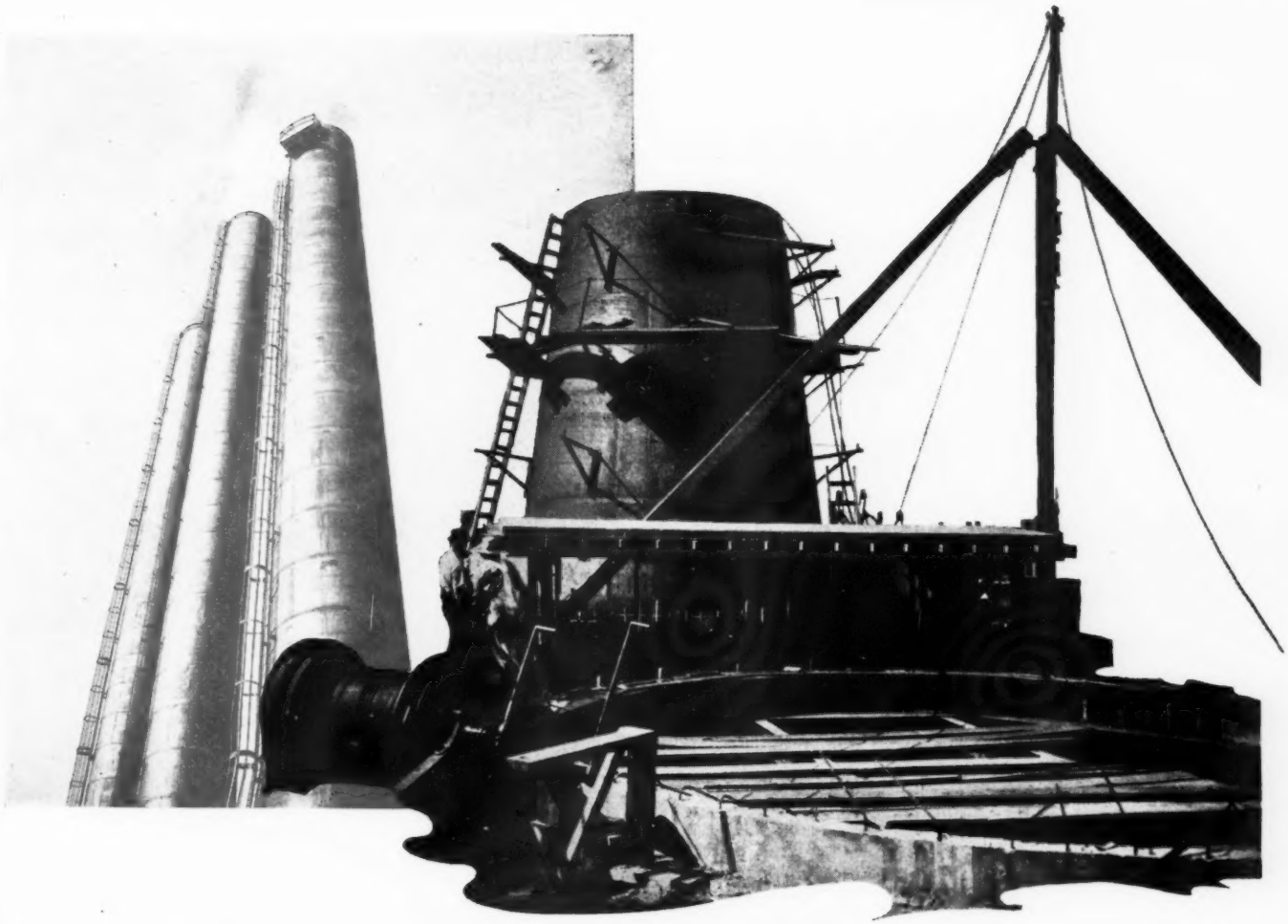


THE JEFFREY MANUFACTURING COMPANY

932-99 North Fourth St., Columbus 16, Ohio

ESTABLISHED 1877

Baltimore 1 Buffalo 2 Cleveland 13 Huntington 11 Milwaukee 11 Pittsburgh 22
Birmingham 3 Chicago 1 Denver 2 Houston 5 New York 7 St. Louis 3
Boston 16 Cincinnati 2 Detroit 32 Morgantown 10 Philadelphia 2 Scranton 3
Salt Lake City 1



GENERAL AMERICAN

Self - supporting Steel Stacks

Every steel stack is especially engineered to meet operating and climatic conditions to assure long service life.

The steel from which the stacks are fabricated is carefully selected with special regard to tensile strength, corrosion resistance, etc. Each section is precision fabricated and before shipment thoroughly inspected to assure freedom from flaws and defects.

Stacks, as well as all other equipment fabricated by General American, shipped in a knocked-down condition, are erected by our Field Erection Department.

OTHER GENERAL AMERICAN EQUIPMENT

Storage Tanks — Water — Oil
Steam Drums
Standpipes
Penstocks
Coal Dryers
Large Diameter Pipe

General American
TRANSPORTATION CORPORATION
process equipment • steel and alloy plate fabrication

SALES OFFICE:
520 Graybar Bldg., New York 17, N. Y.
WORKS: Sharon, Pa.; East Chicago, Ind.

GATX GENERAL AMERICA

OFFICES: Chicago, Louisville, Cleveland, Sharon, Orlando, St. Louis, Salt Lake City, Pittsburgh, San Francisco, Washington, D. C.

Otis maintenance man measuring the clearance between brake drum and brake lining. Standard clearance for the brake illustrated is six one-thousandths of an inch — or about twice the thickness of a human hair.

PERSONAL SERVICE BY THE MANUFACTURER

OTIS MAINTENANCE FOR OTIS ELEVATORS

Every elevator under Otis Maintenance receives attention that is made to order. Every inspection is a personal service; adapted to meet specific conditions, volume of traffic handled, and type of equipment installed.

This service is brought to your building through one of the 245 local Otis offices specializing in your requirements and the needs of your community.

It is important to note that Otis Maintenance does not stop there. Each local office is backed up and supervised by a Maintenance district office, which provides special tools and materials. Back of the districts are ten zone offices providing even greater facilities. Back of the zones is the headquarters organization with all of the engineering, research and production capacity of the manufacturer of more than half of the world's elevator equipment.

Through all of this organization your personal Maintenance service never loses its identity. Individual reports on performance are received and analyzed straight through to headquarters. Every resource of the entire Otis Elevator Company is devoted to making your service meet Otis standards.

Complete, flat rate Maintenance Service for Otis elevators is available through your local Otis Elevator Company office.

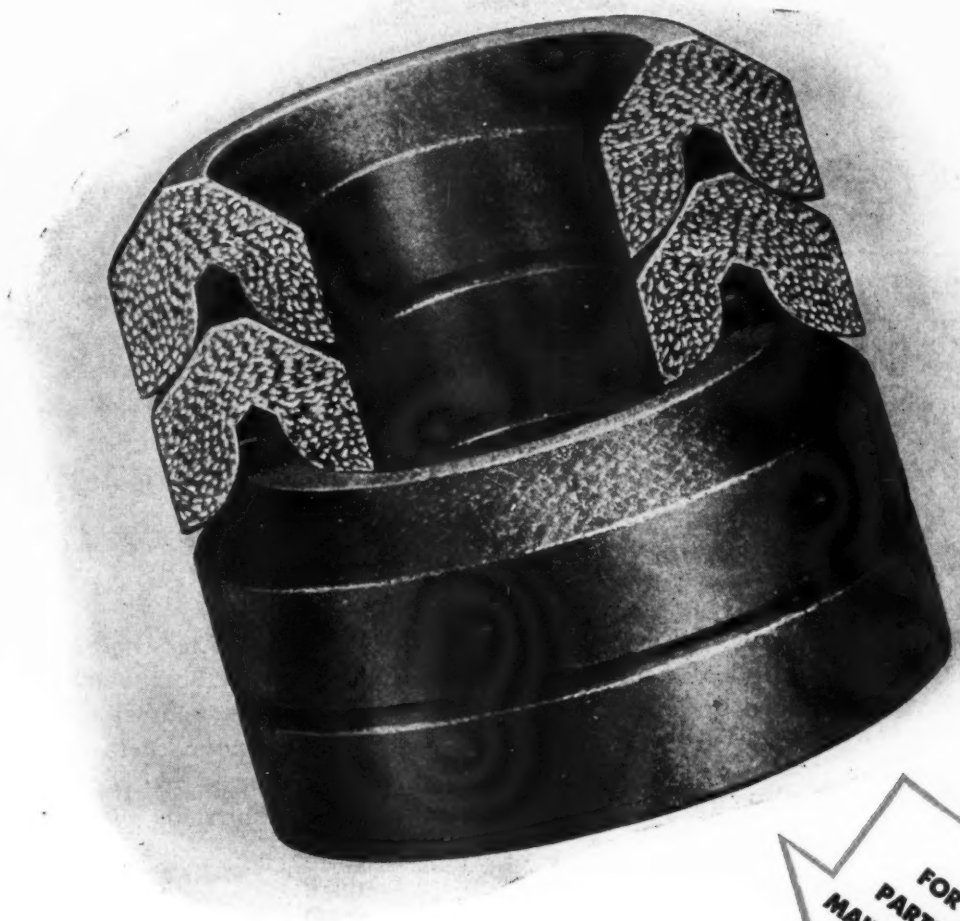
Otis

ELEVATOR COMPANY

OFFICES IN ALL PRINCIPAL CITIES

PALMETTO *Pyramid*

THE MOST TALKED ABOUT IMPROVEMENT IN MOLDED "VEE" PACKINGS



Engineers everywhere are talking about the newest addition to the PALMETTO family. PALMETTO Pyramid, a new design principle in all-purpose molded "Vee" type packings, seals completely with simple finger-tightening . . . and is *entirely automatic* in performance. A unique "arrowhead reservoir" stores and distributes lubricant. The result is reduced friction and less wear and that means longer packing life and longer equipment life.

GREENE, TWEED & CO.

Manufacturers of PALMETTO Packings

BRONX BLVD. AT 238th ST. NEW YORK 66, N. Y.

Plants at New York, N. Y. and North Wales, Pa.

FOR FULL PARTICULARS MAIL THE COUPON PLEASE

OT-1666

GREENE, TWEED & CO.

New York 66, N .Y.

☐ Send descriptive literature covering PALMETTO Pyramid Packings

☐ Send PALMETTO representative to discuss packing

Name .....

Company .....

Street .....

City ..... *State* .....

HERE ARE THE MAIN SOURCES OF BELT TROUBLE AND HOW *Republic Builds a Belt to Stop Them*

Heavy industrial drives, operating under severe shock loads and stresses, go to work on inadequate belt strength or points of imperfection, making premature failure inevitable. Fabric gives transmission belts their strength, and Republic's Challenger Reprene is built from heavy, hard-woven duck. Each ply of the finished construction is continuous in full width, without seams or splices, and is minutely inspected for possible flaws. High speeds and small pulleys burn up belts with insufficient flexibility. Challenger Reprene has a specially developed rubber skim coat between plies that provides unusual flexibility and ply adhesion, compounded to dissipate heat build-up. Belt stretch—which means repeated downtime for shortening and refastening—usually is due to a sacrifice of ruggedness for flexibility. Here, again Challenger's strength assures remarkably stretchfree characteristics. Throughout industry, this specially built belt has proved an assured means to efficient operation on the most difficult drives.

Consult your nearby Republic Distributor

REPUBLIC RUBBER

DIVISION

LEE RUBBER & TIRE CORPORATION

YOUNGSTOWN 1, OHIO

REPUBLIC INDUSTRIAL PRODUCTS
YOUNGSTOWN, O.

LEE DELUXE TIRES AND TUBES
CONSHOHOCKEN, PA.

WE ARE PARTICIPANTS IN THE OWNERSHIP AND OPERATION OF NATIONAL SYNTHETIC RUBBER CORPORATION

SPACE SAVER

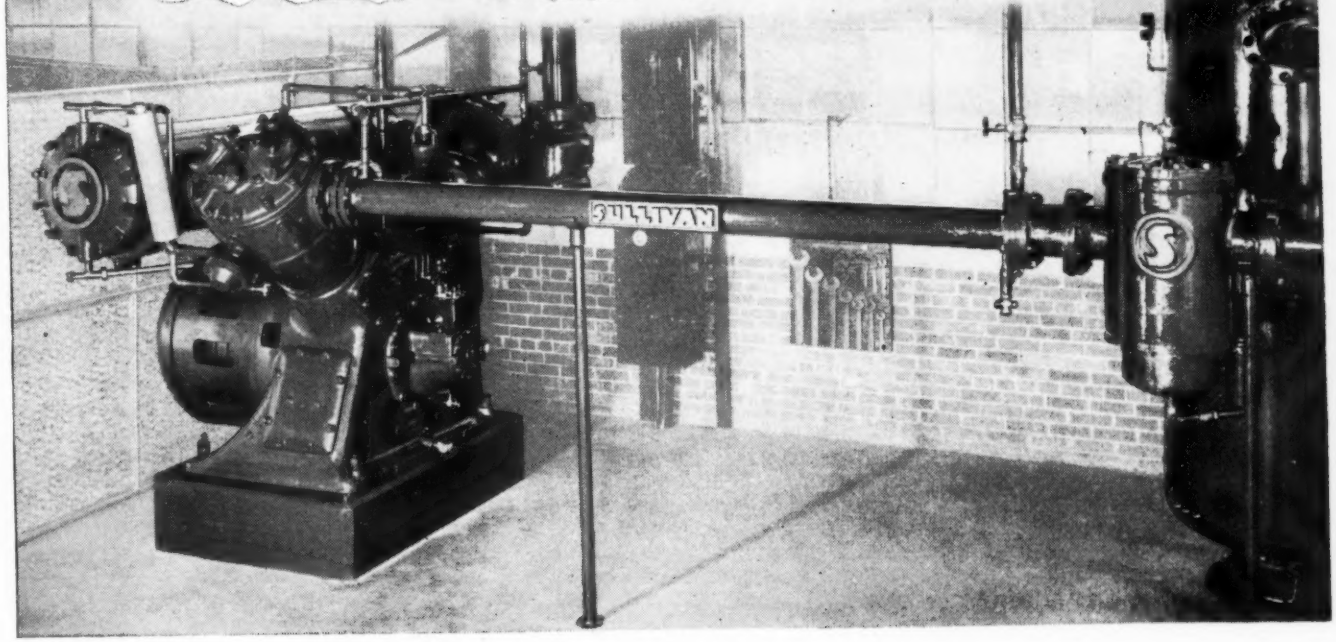
THAT PROVIDES LOW-COST COMPRESSED AIR

SERIES WN-112

for capacities of 378 to 1828 cfm, pressures up to 125 psi

If space is precious in your plant, that's one more reason why you'll want to specify the Sullivan WN-112 Compressor. It's more compact than other compressors of equivalent capacity because of its advanced design and use of alloy metals—and it operates more economically . . . gives longer heavy duty service. Installation is simple, and maintenance low.

For full details write for bulletin A-52



Sullivan Air Compressors

PORTABLE AND STATIONARY — ¼ HP TO 600 HP

ALWAYS DEPENDABLE!

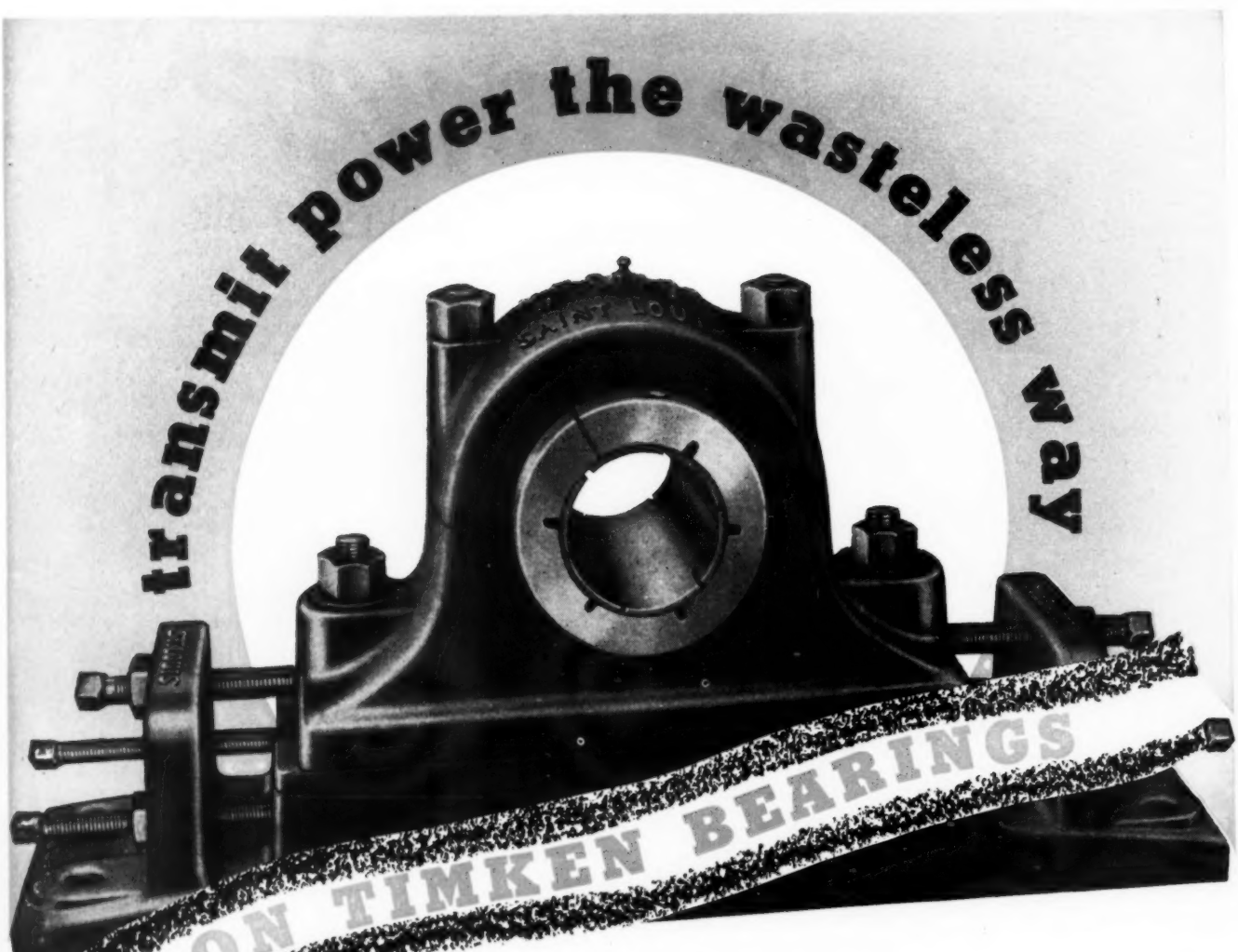
W&D 1512

Consult a Joy Engineer

SULLIVAN DIVISION

JOY MANUFACTURING CO.

GENERAL OFFICES: HENRY W. OLIVER BLDG., PITTSBURGH, PA.



Medart SS Type Pillow Block equipped with Timken Tapered Roller Bearings mounted on adjustable base.

A tremendous volume of power has been — and is being — wasted through obsolete mechanical transmission equipment; burned up by friction before it reaches the point of application.

Every unit of power lost means an increase in power cost. In addition an excessive amount of lubricant is required together with many extra man-hours to apply it. There is, furthermore, an ever-present danger of product damage or contamination through lubricant leakage. Maintenance is high because, among other things, rapid shaft wear is prevalent.

Add to all this the constant threat of unscheduled work stoppages through power interruptions resulting from transmission failures and you have a strong case in favor of replacing your obsolete, worn-out, plain bearing transmission equipment with modern Timken Bearing Equipped units *now*. The Timken Roller Bearing Company, Canton 6, Ohio.

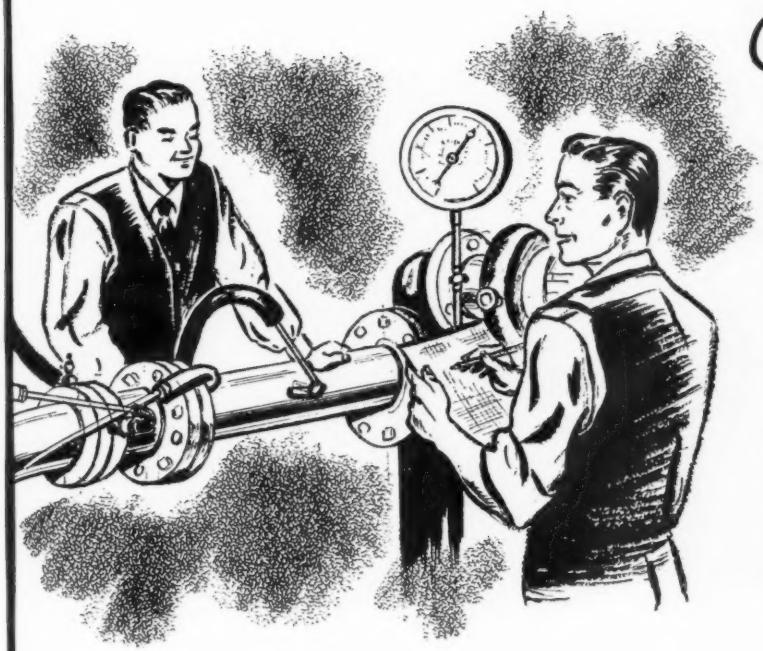
TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS

Paying Off IN LONG-TERM PERFORMANCE

"Buffalo" CLOSE-COUPLED PUMPS



Many plant executives, checking the performance of their pumping systems against the budget, have found that upkeep, not first cost, is the major factor. They have noted "delivery up to rated capacity" in every "Buffalo" Pump . . . even after years of service!

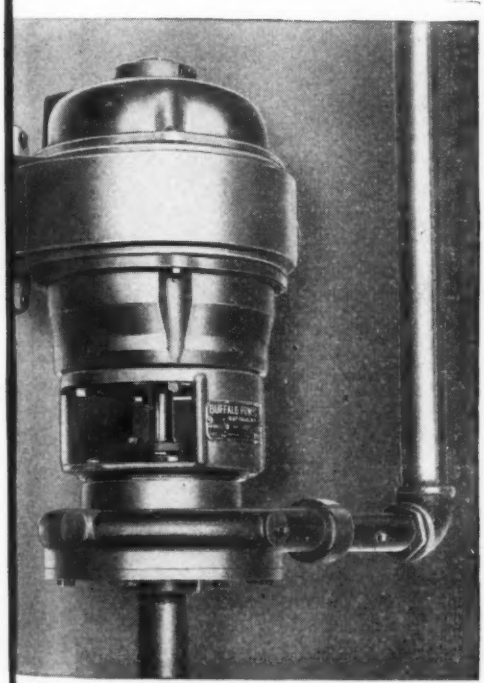
Your maintenance savings in "Buffalo" Close-Coupled Pumps come from over-size, long-wearing parts . . . each readily accessible for replacement. Standard construction features bronze fittings with bronze impellers, wearing parts and glands. High delivery, too, means efficient use of your power.

A check on *your* system may well disclose ways of cutting costs . . . and *stepping up performance!* Why not ask your local "Buffalo" representative, or write us for Bulletin 975-B?

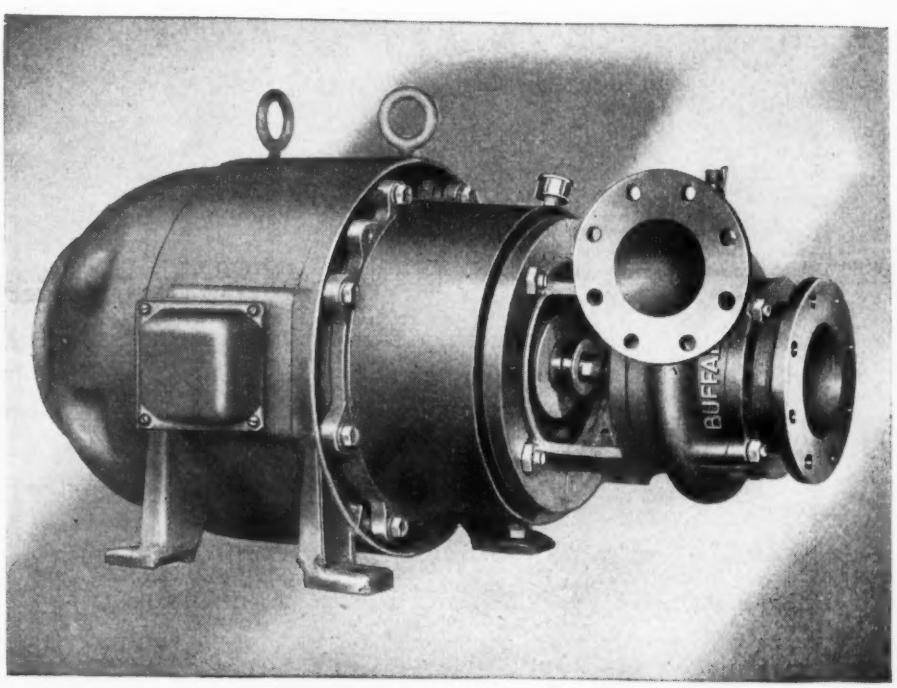
BUFFALO PUMPS, INC.

488 Broadway Buffalo, N. Y.

Canada Pumps, Ltd., Kitchener, Ont.

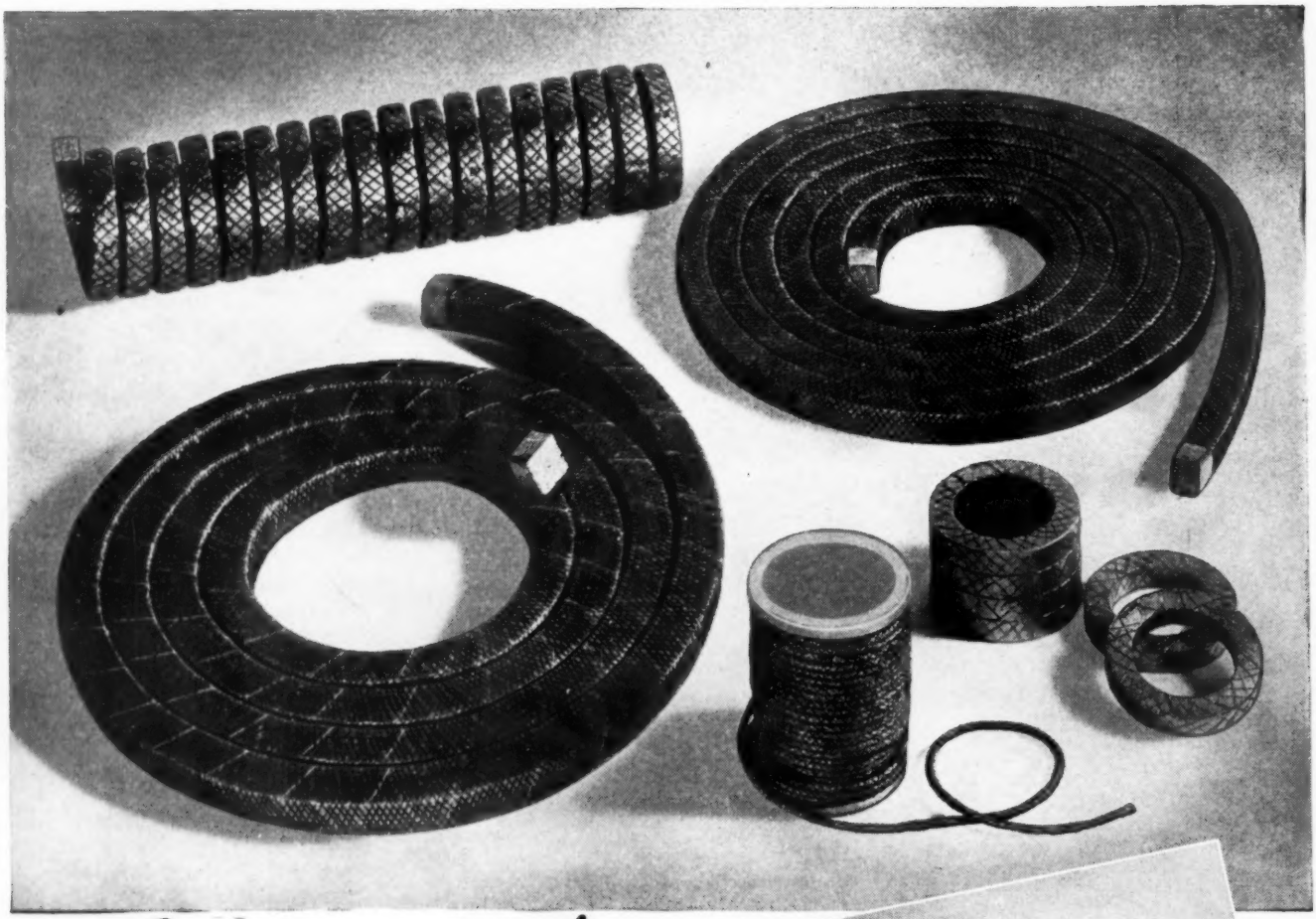


alo CCS with threaded Inlet, Arranged For Vertical ration.



Buffalo Close-Coupled Pump with Flanged Inlet. All pumps feature adjustable discharge position.

"Buffalo" CLOSE-COUPLED PUMPS



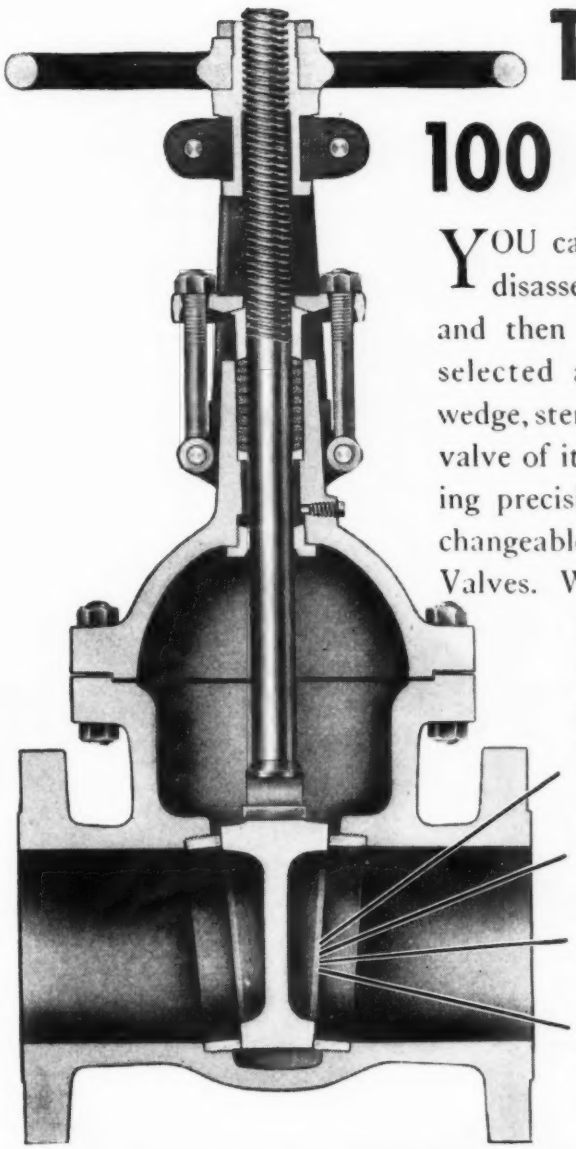
Easy to Apply

GARLOCK *Plastallic* packing is easy to apply. You just tamp the loose form into the stuffing box and draw up on the gland. Coil, spiral and ring forms are applied in the usual way. And when additional packing is needed, you merely back off the gland and add more *Plastallic*. In service it combines into one homogenous mass. A special feature of GARLOCK *Plastallic* coil packing is that it is out-of-square to fit either of two different packing spaces. Save time with *Plastallic!*

THE GARLOCK PACKING COMPANY, PALMYRA, NEW YORK
In Canada: The Garlock Packing Company of Canada, Ltd., Montreal, Que.

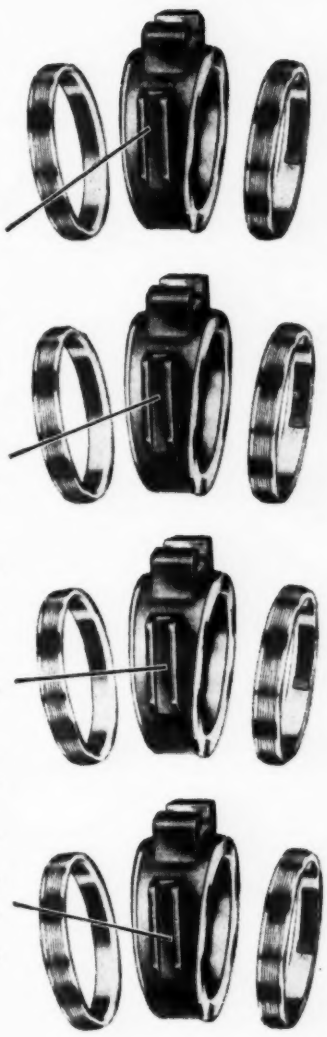
GARLOCK 924 PLASTALLIC—for acids and strong chemical solutions.
GARLOCK 926 PLASTALLIC—for water, steam or air up to 550° F.
GARLOCK 927 PLASTALLIC—for gasoline, oils, ether, etc., up to 550° F.
GARLOCK 928 PLASTALLIC—for steam and hot oils over 550° F.
GARLOCK 929 PLASTALLIC—for water, steam and general services up to 550° F.
GARLOCK 930 PLASTALLIC—for gasoline, oils, gases, etc., at high or low temperatures.
GARLOCK 931 PLASTALLIC—for steam, water or air at high or low temperatures.

GARLOCK *Plastallic*

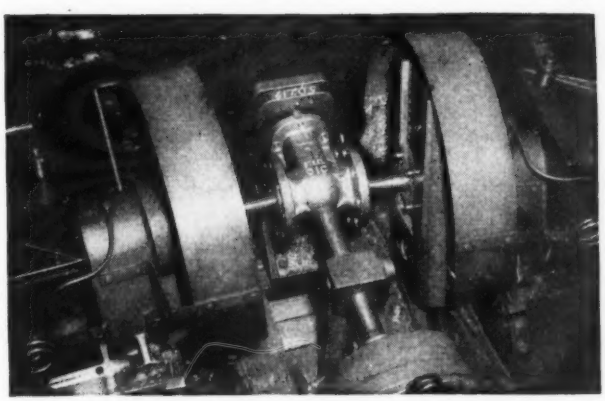


The *Same* Precision 100 times in 100 valves

YOU can take 100 OIC Steel Valves, disassemble them, shuffle the parts, and then reassemble them with parts selected at random. Any seat ring, wedge, stem, bushing, or yoke nut fits any valve of its size and type. This unvarying precision which makes parts interchangeable is a regular feature of OIC Valves. We developed the machinery that makes this possible. This machinery is found in only one plant — the OIC plant at Wadsworth, Ohio.



Uniform precision is one of the many reasons why OIC Valves improve valve performance in the complete range of applications for your industry. Your OIC Distributor can give you added reasons. He has a complete line of globes, gates, angles, and checks — iron, bronze, and steel — all types and sizes.



Only at OIC

This machine which automatically achieves identical precision on each part eliminates the common practice of "custom" fitting individual wedges to each pair of seat rings. It is an exclusive OIC development which insures better valve performance.

OIC VALVES

THE OHIO INJECTOR COMPANY, WADSWORTH, OHIO

SOFT

TOUGH

DUCTILE

Globeiron

SEAMLESS TUBING

INDUSTRY asked for a seamless tubing with high magnetic permeability, uniform ductility, softness, toughness, and corrosion resistant properties. We supplied it in Globeiron Seamless Tubing. Because of its right combination of all these properties, Globeiron is extensively used in the electrical and radio industries; housings for generators and motors are frequently fabricated from Globeiron. It is extensively used for many pressure tubing applications. It can be worked hot or cold.

Some of your tubing problems may be profitably solved through the use of Globeiron Seamless Tubing. Globe engineers, Globe laboratory facilities are at your service. Write for Bulletins 109A and 113.

GLOBE STEEL TUBES CO.
MILWAUKEE 4, WIS., U. S. A.

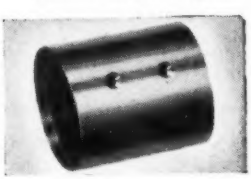
5028

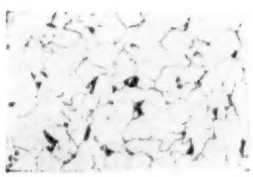
Globeiron is a high purity, low carbon iron, often known as "ingot iron". The physical properties of Globeiron make it ideal for difficult forming operations.

High Magnetic Permeability

(Generator Housing)

Housing for generators and motors may be thinner and lighter when made of Globeiron. The shell of the Dynamotor shown here is an example of Globeiron adaptability.

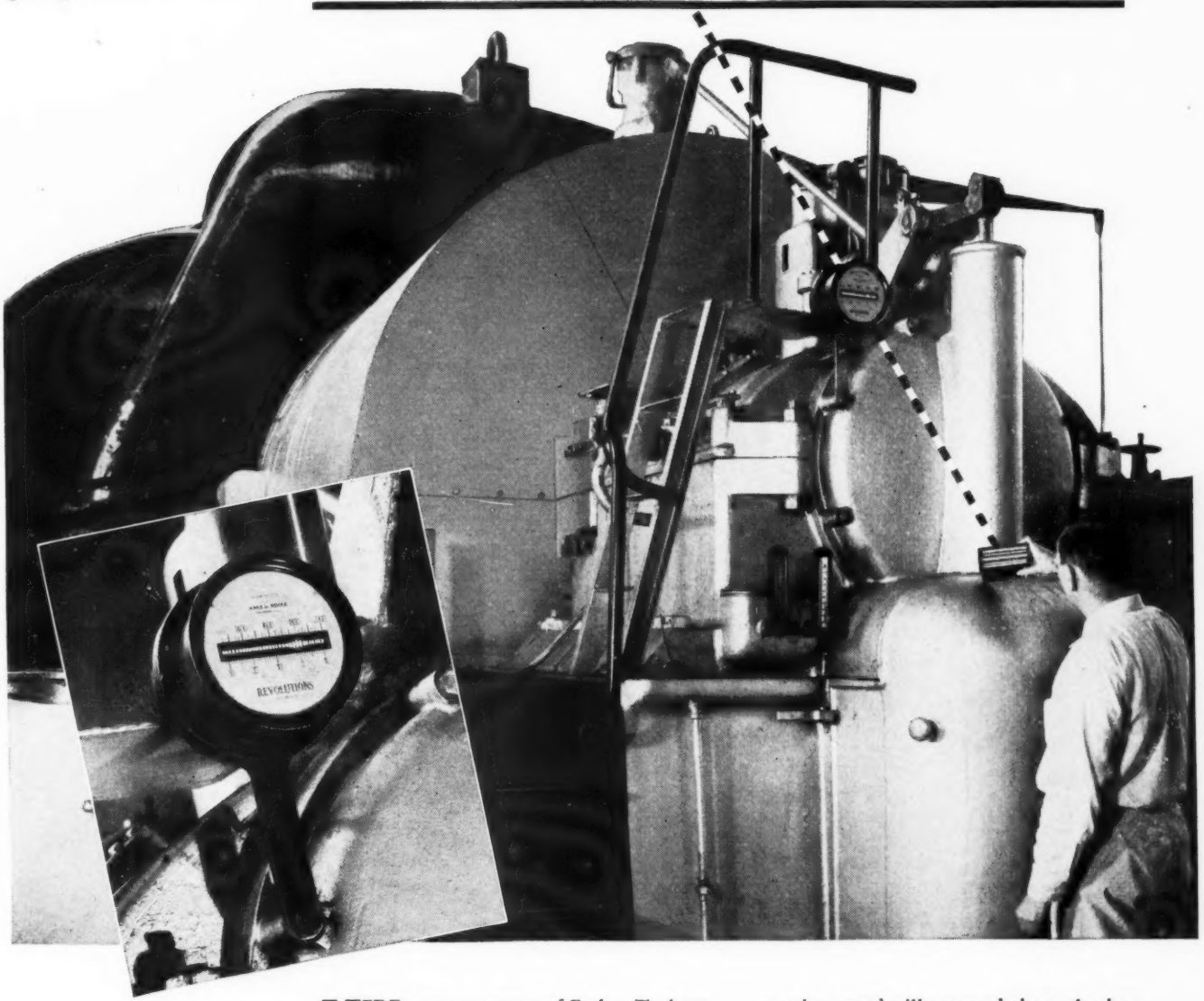




Under the microscope (mag. 200x Nital Etch) Globeiron shows a uniform structure of almost pure ferrite with only occasional patches of pearlite.

★ PRESSURE TUBES
★ MECHANICAL TUBING
★ CONDENSER & HEAT EXCHANGER TUBES ★ GLOBEIRON HIGH PURITY IRON SEAMLESS TUBES
★ GLOWELD WELDED STAINLESS STEEL TUBES ★ SEAMLESS STAINLESS STEEL TUBES

Resonance is the Reason
behind "FRAHM" TACHOMETERS



For a complete description of Frahm Tachometers with list of types and ranges commonly supplied write for a copy of new Bulletin 1810-P.

HERE are two types of Frahm Tachometers—one permanently mounted, one portable—measuring the speed of a 60,000 kva turbo-generator. Although neither has any connection with the rotating element they are accurately indicating its speed—1800 rpm. How do they do it?

Resonance is the reason—the operating principle. Mere placement of the tachometer case in contact with almost any external part of the machine will cause the tuned reeds to pick up the minute vibratory impulses. The reed that is in tune with the machine's rotative speed will respond, the scale showing the speed in rpm. This principle and the method of indication are unique among speed-measuring instruments.

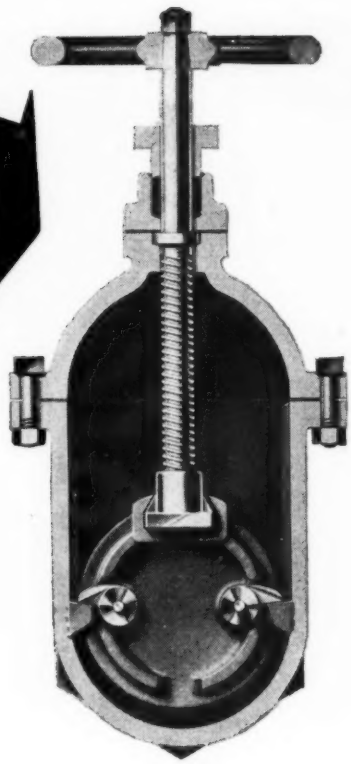
The simplicity of operation of the Frahm Resonant-Reed Tachometer is matched by its ease of installation and freedom from maintenance. There are no parts to wear, adjust, lubricate or renew. The instrument can be used in any position and gives years of trouble-free service. Various types (for rigid mounting or hand use) are available, in ranges from 900 to 100,000 rpm.

James G. **BIDDLE CO.**
ELECTRICAL & SCIENTIFIC INSTRUMENTS
1316 ARCH STREET • PHILADELPHIA 7, PENNA.

Every feature you want in an

IRON BODY DOUBLE-DISC GATE VALVE

is in this KENNEDY DESIGN



It will pay you to study the operating mechanism of this Kennedy Standard Iron Body Double-Disc Gate Valve.

First notice its simplicity . . . it consists only of two discs, two cams and a stem nut.

When the valve is closing, the cams do not operate until the port opening is completely closed. The lugs on the body then engage with the arms on the cams, causing them to revolve, and forcing the two discs tight against the seats *at the exact moment of closure.*

When opening the valve, the first movement of the stem disengages the arms of the cams from the lugs in the body, immediately releasing the discs.

Then note these additional important advantages . . . location of actuating lugs well above the bottom of the valve to prevent sediment from interfering with correct operation . . . perfect operation with either disc toward the pressure, and with valve in any position . . . interchangeability of both discs and cams, so that mechanism cannot be assembled incorrectly.

This design, together with the many other Kennedy Valve types for all standard requirements, is fully described in the 240-page Kennedy Catalog which will be sent on request.

Buy From Our Distributor

YOU WANT THESE VALVE FEATURES
. . . you'll find them in this KENNEDY design

1. **Generous Strength . . .** Body and bonnet are of high-grade dense metal with ample thickness and rounded fillets. Stem has large diameter and extra large number of contact threads.
2. **Easy Operation . . .** Stem and stem contact surfaces are accurately threaded. Deep stuffing boxes permit tightness without undue pressure on packing. Large handwheel gives firm, comfortable grip.
3. **Lasting Tightness . . .** Discs and seats seat accurately, and their sturdy design resists distortion and has special provisions for take-up of wear.
4. **Long Life . . .** Many Kennedy valves have been in daily use a quarter century and more.
5. **Convenient Repacking . . .** Glands and packing are easily accessible.
6. **Economical Maintenance . . .** Long wear built into all parts, and adjustments or other attention are seldom required.

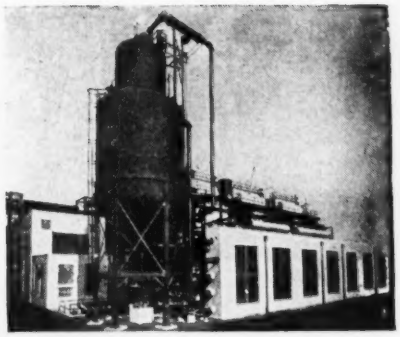
THE KENNEDY VALVE MFG. CO.
Elmira, New York

KV-135

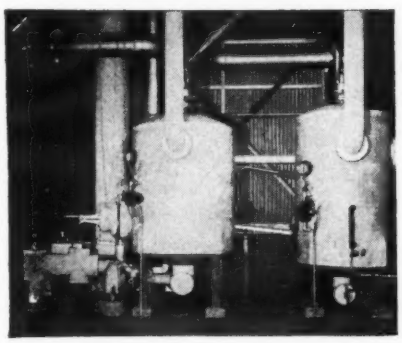
KENNEDY *valves - pipe fittings - fire hydrants*

Parade of Permutit

power plant equipment for controlling water quality



DEAERATING HEATER—Prevents corrosion by removing oxygen and free CO_2 from feedwater. Designed for pressures up to 100 pounds or higher, capacities to 1,400,000 pounds per hour or higher. Utilizes bled or exhaust steam.



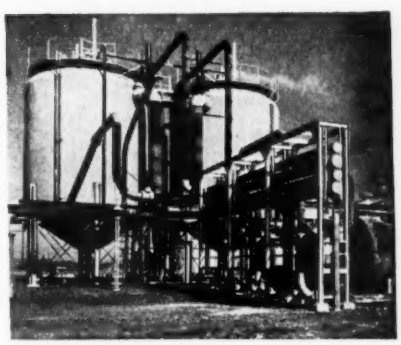
CONTINUOUS BLOWOFF—Reduces foaming and priming. Maintains uniform concentration of salts in the boiler salines. Both high and low flash types. Heat from blowoff water is recovered by means of flash tanks and heat exchangers.

To help you in planning for the critical reconversion period ahead, Permutit* presents in review some of the types of water treatment equipment that power plants favored to keep boilers clean in 1945.

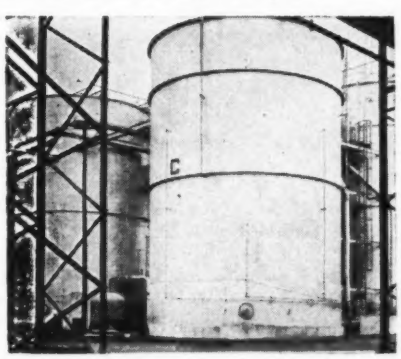
Other Permutit processes (not shown here) for control of water quality include Spaulding Precipitators, Degasifiers, and Demineralizing Processes. Whatever type of water problem you may encounter, consult Water Conditioning Headquarters.

For more details write to The Permutit Company, Dept. P9, 330 West 42nd St., New York 18, N. Y., or Permutit Co. of Canada, Ltd., Montreal.

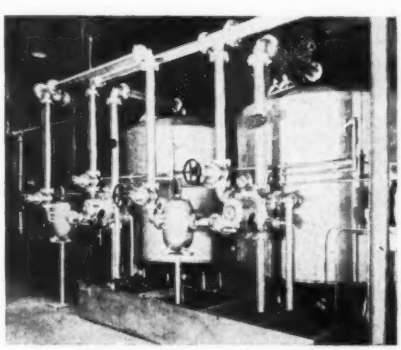
*Trademarks Reg. U. S. Pat. Off.



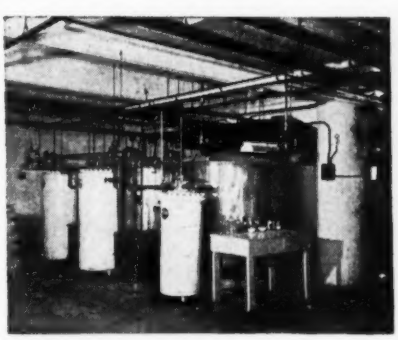
HOT LIME SODA—Lime and soda ash precipitate bulk of water hardness as calcium carbonate and magnesium hydroxide. Sludge is settled out and water filtered. Integral deaerator deaerates the water.



SILICA REMOVAL—Silica content is reduced, and deposits are eliminated. Reagents used are low in cost, do not add soluble by-products.



PERMUTIT ZEO-KARB* H—Removes both hardness and bicarbonates from water. Effluent contains no encrustants, is reduced in total solids and alkalinity.



DEMINERALIZERS—By a simple process in the cold, Permutit Demineralizers produce a water practically free of salts—a low-cost substitute for evaporated water.

PERMUTIT

Manufacturers of ALL types of water treatment equipment

WATER CONDITIONING HEADQUARTERS

It's good business to begin with Good Water

Are you planning to take in the Power Show, Bill?

I can't afford to miss it. They're showing more *new products* this year than ever!

YES, the 1946 Power Show will feature the exhibits of over 350 manufacturers — all presenting the newest developments in power equipment. Come and study the displays, see the demonstrations. Discuss your problems first-hand with the informed representatives of exhibitors. Learn how you can improve power production and power utilization in your plant.

This is *your* show. General public is not admitted. Attendance only by invitation or registration. Bring your staff with you.

1414

17th NATIONAL POWER SHOW

GRAND CENTRAL PALACE, NEW YORK • DEC. 2-7, 1946

NEED STEEL?

Here's the way to get it

Scrap is needed to produce new steel. Millions of tons of steel products that have served their usefulness are idle—obsolete machines, structural shapes, pipe, old boilers and dozens of other awkward pieces.

Flame-cutting is a fast and economical way to reduce steel to pieces of the right size for charging into furnaces for the production of new steel. Line up a scrapping program *now*—we will be glad to help. Just call the nearest Linde office.

THE LINDE AIR PRODUCTS COMPANY

Unit of Union Carbide and Carbon Corporation

30 E. 42nd St., New York 17, N. Y. UCC Offices in Other Principal Cities

In Canada: Dominion Oxygen Company, Limited, Toronto

HOMESTEAD LEVER-SEALD VALVES OFFER ALL THESE ADVANTAGES

Instant
Stick-proof operation

•

Quarter-turn fully opens or closes.

•

Positive seal without lubrication.

•

Seating surfaces always protected in both open and closed positions. Corrosion practically eliminated.

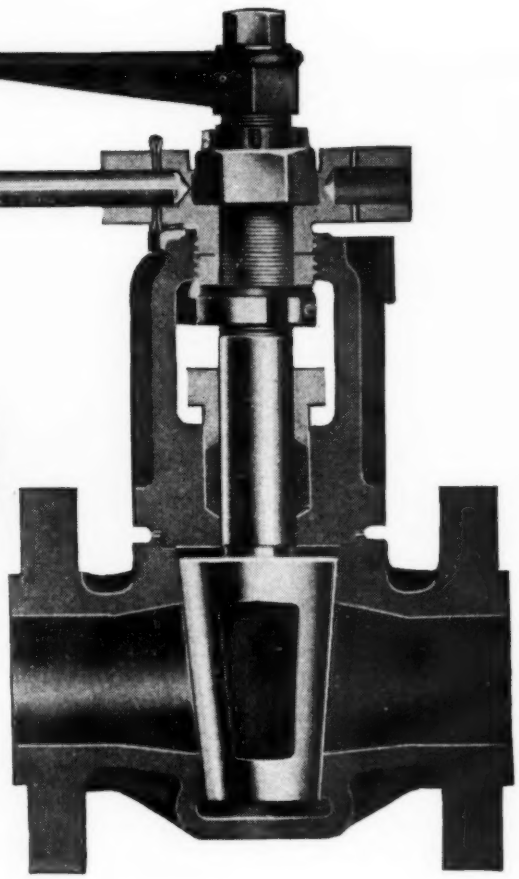
•

Unobstructed straight-line fluid flow.

•

All operating parts protected from damaging effects of service conditions and weather.

and they're **STICK-PROOF** *too*



That is why for 15 years, they have been first choice in difficult services where extremes of temperature or pressure or the corrosive action of line fluids would cause ordinary valves to "stick" or "seize."

Due to their exclusive "**Lever-Seald**" construction, they render instant, **Stick-Proof** service at all times and under all conditions. They operate *faster,* too—*16 to 28 times faster than screw-stem-type valves.*

Because all operating parts are protected from the damaging effects of line fluids, service conditions and weather, long life, low maintenance cost and trouble-free service are assured.

Homestead Lever-Seald Valves are made in metals and alloys to meet service requirements; sizes 1½" to 12", for pressures from vacuum to 1500 pounds. Write for detailed information and copy of Valve Reference Book No. 38.

Operation of a **Homestead Lever-Seald Valve** is simple and easy. Seating pressure is first relieved (with the lower lever) just enough to overcome friction and free the plug. Then a *quarter-turn* of the upper lever fully opens or closes the valve. Full seating pressure is again applied with the lower lever to make a positive, leakless seal. This *stick-proof* construction is only one of many **Homestead Lever-Seald Valve** features assuring long, economical, trouble-free service.

HOMESTEAD VALVE MFG. CO.

P. O. BOX NO. 210 **CORAOPOLIS, PA.**

The New 2½" to 4" Geared Pipe Threader

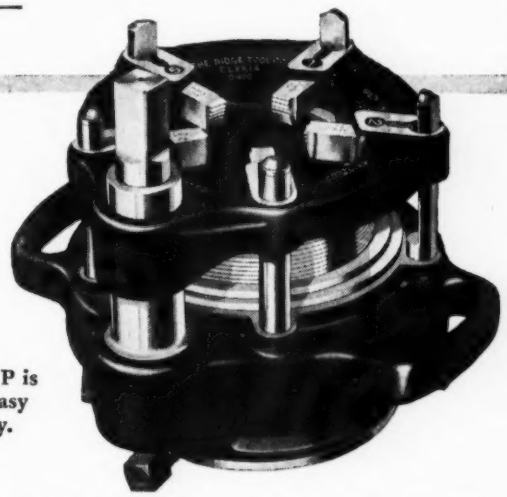
that's a lot easier to use

New RIDGID No. 4P

● Surprisingly easy to handle — that's one big advantage you find RIDGID has engineered into this new 4P. Geared die stocks for 2½" to 4" pipe can't be featherweight but they can be far easier to use — and this one is. It gives you smooth perfect threads with least possible effort. Look, now —

Balanced loop handles make new 4P extra easy to put on pipe.

New 4P is extra easy to carry.



New 4P has 5 chasers for smoother threading.

Quick-setting workholder sets to pipe size before putting on pipe.

Balanced Loop-handles. Easy to pick up, easy to put straight on pipe — no slipping or tipping over. And easy to carry with one hand. . . .

Quick-setting Workholder. Mistake-proof — you set it to size *before* you put it on pipe, then tighten only one screw. No bushings to bother with or lose. . . .

Easy Pipe Threading. Four sets of 5 high-speed steel dies easily cut clean accurate threads, standard or tapered, drip threads, short nipples. Ratchet handle with each 4P; RIDGID universal drive shaft available for power drive. . . .

Extra Easy Upkeep. Twin-anchored drive shaft turns in oilless bronze bearing — never needs oil. Grease packed gear is fully enclosed, safe for you, safe from dirt and wear.

●

YOU'LL LIKE the new rugged steel-and-malleable 4P — it's a true worksaver RIDGID, precision made throughout — more for your money. Production still limited — see it at your Supply House.

Millions of RIDGID Tools in use

★ RIDGID ★

WORK-SAVER PIPE TOOLS

The Ridge Tool Company
Elyria, Ohio, U. S. A.

COPPER ALLOY BULLETIN

MARINE AND POWER EDITION

REPORTING NEWS AND TECHNICAL DEVELOPMENTS OF COPPER AND COPPER-BASE ALLOYS

Prepared by Bridgeport Brass Company "Bridgeport" *Headquarters for BRASS, BRONZE, and COPPER*

Condenser and Heat Exchanger Tubes

Most Common Factors Influencing Corrosion Rate

Numerous laboratory examinations of condenser tubes which in some instances have given many years of service and in others only a few weeks or months of service, have revealed that there are probably at least a dozen different factors which influence the rate of corrosion of condenser or heat exchanger tubes in power plants. These factors may function in an adverse manner or they may be beneficial as listed in the table below. The problem is complicated by the interaction of these factors. This should not necessarily discourage us from trying to uncover the most troublesome factor or combination of factors. In many instances individual consideration of all of these corrosion rate factors has helped to uncover the most troublesome one.

In previous issues of the Copper Alloy Bulletin, we discussed the effects of alloy composition and water composition, as well as the acceleration of corrosion due to the deposit of foreign matter. We also mentioned a few of the preventive measures to increase tube life such as cleaning of tubes and removal of a large percentage of entrained gases from the circulating water before it enters the tubes.

Steam and Steam Condensates

All of the copper base alloys usually have excellent corrosion resistance to steam and steam condensates of low impurity content. Occasionally stress corrosion cracking or corrosion grooving localized near tube sheets and supports is encountered where the condensate contains much ammonia. Corrosion grooving sometimes occurs when much carbon dioxide is present. Thinning of tubes has also occurred when much hydrogen sulfide was present.

High Water Velocity May Lead to Impingement-Corrosion

In condenser and heat exchanger tubes the movement or turbulence of some waters at the inlet ends of tubes frequently leads to localized corrosion—commonly called "impingement-corrosion" or "inlet-end-corrosion". The seriousness of this type of attack varies with the alloy composition, water composition, water velocity and the quantity and size of entrained gas bubbles and sand. When much entrained gas is present in the water stream, the impingement corrosion pits are undercut on the down stream side at those points where the gas bubbles (second phase) impinge on the metal surface. Aluminum Brass, 70/30 Cupro Nickel containing about ½% iron and Duronze IV (arsenical aluminum bronze) have the best corrosion resistance to this type of attack in sea water. "Inlet-end-corrosion" is also combated through the use of various protective measures applied to the inlet ends of tubes, such as Flowrites, plastic inserts, and coatings.

Effects of High Velocity Steam

Steam containing droplets of water (second phase) traveling at high velocities and impinging on condenser and heat exchanger tubes will rapidly corrode most metals. This is usually encountered in those tubes facing the steam inlet and steam lanes. The surface is roughened by numerous cones all tilted in one direction. Sometimes the tips of the cones do not develop and the corroded surface may be covered with a large number of minute cones with rounded tops. Trouble from this source is kept to a minimum by (1) removing as much moisture as possible from the steam, (2) use of the most corrosion resistant metals, (3) maintaining high quality steam and (4) the use of steam deflector plates.

Effect of Internal and External Stresses

The effect of applied (static) or residual (resulting from cold drawing) stresses upon the copper base alloys varies considerably depending upon the composition of the alloy and the corrosive environment (moist ammonia). Certain copper alloys under these conditions may fail from localized corrosion (stress corrosion or season cracking) in the form of narrow cracks which gradually penetrate the tube wall. This type of corrosion is best combated by keeping stresses and the concentration of ammonia at a minimum; where these cannot be controlled then the use of copper, 70/30 cupro nickel, or Duplex tubing should be considered. Residual stresses resulting from cold work during the manufacture of tubes are eliminated by the stress relief obtained by annealing to meet the grain size requirements of A.S.T.M., Federal, Navy, and other specifications. Duplex Tubes, however, are normally supplied in the hard condition.

Cyclic stresses associated with vibration may lead to fatigue or corrosion fatigue cracking of condenser and heat exchanger tubes. These failures can be recognized from their location, that is, a few up to several hundred minute circumferential cracks develop midway between tube support sheets or within a few inches from the tube sheets. In addition such tube failures generally occur at those points where the steam or vapors enter the condenser or heat exchanger, that is, in tubes facing the inlet or vapor lanes (top to bottom of lane). Stopping the vibration is the most satisfactory way to combat this situation. This has been done through the use of tube stiffeners and additional tube support plates.

Alloy Selection

As we learn more about the complex subject of corrosion, we begin to appreciate the very important role played by the metals and alloys from which condenser and heat exchanger tubes are made. Engineers who take the trouble to study experimental lots of different alloys tested under actual service conditions are of course in an excellent position to know, when the time for retubing comes around, which alloy will serve best. Such results lead to the purchase of tubes on a service basis rather than on a first cost basis. Further information on condenser and heat exchanger tubes can be obtained from our Technical Service Dept. Write for your copy of Bridgeport's Condenser Tube Manual—112 pages full of technical data and useful tables.

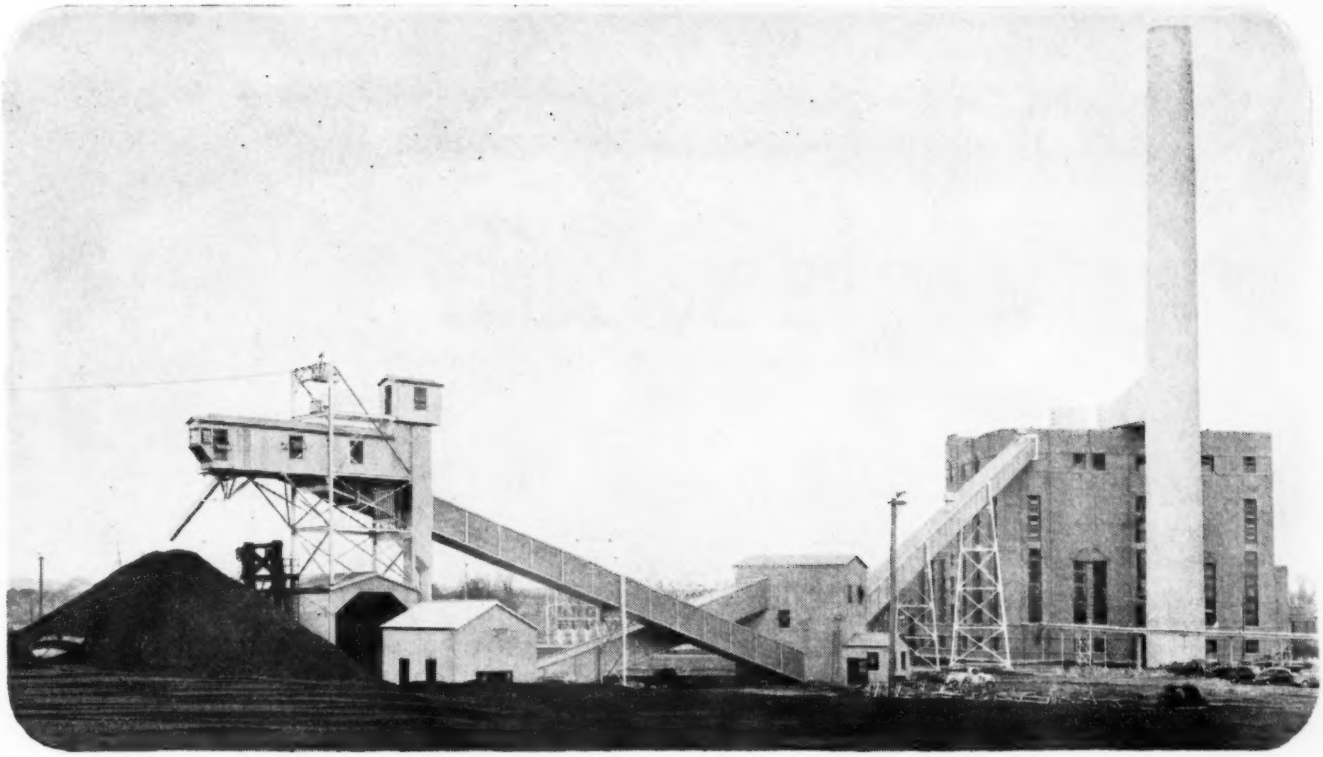
Most Common Factors Influencing the Rate of Corrosion

The letter or letters in parentheses following each factor indicates whether or not this factor generally has an adverse ("a") or beneficial ("b") effect on the corrosion rate as the value of concentration increases.

1. Alloy Composition ("a" or "b")
2. Composition of Water
   - (a) Anions, specific nature and concentration ("a" or "b")
   - (b) Cations, specific nature and concentration ("a" or "b")
   - (c) Total dissolved solids ("a" or "b")
   - (d) pH and pHs ("a" or "b")
   - (e) Gases, H_2S, Cl_2, CO_2, O_2, NH_3 (usually "a" occasionally "b") rate of supply, concentration, distribution.
   - (f) Organic Material, specific nature and concentration ("a" or "b")
   - (g) Total suspended matter, nature, size, etc. ("a" or "b")
   - (h) Conductivity ("a")
3. Composition of Steam and Steam Condensate Similar to items 2a to 2h
4. Nature and Distribution of
   - (a) Corrosion products ("a" or "b")
   - (b) Silt and debris ("a" or "b")
5. Velocity of
   - (a) Water with ("a") and without a second phase (solid or gas)
   - (b) Steam with ("a") and without a second phase (liquid)
6. Stress
   - (a) Static ("a")
   - (b) Residual ("a")
   - (c) Cyclic ("a")
7. Design of Heat Exchanger ("a" or "b")
8. Operation of Heat Exchanger
   - (a) Continuity of operations (affects factors 5, 6, 8, 9 and 11) ("a" or "b")
   - (b) Method of cleaning (affects factor No. 4) ("a" or "b")
9. Temperature on Outside and Inside
   - (a) Low ("a" or "b")
   - (b) High ("a" or "b")
10. Pressure on Outside and Inside
    - (a) High ("a")
    - (b) Low ("b")
11. Galvanic Coupling ("b")
12. Physical Properties ("a" or "b")
    - (a) Hardness, (b) microstructure
    - (c) Fatigue Characteristics

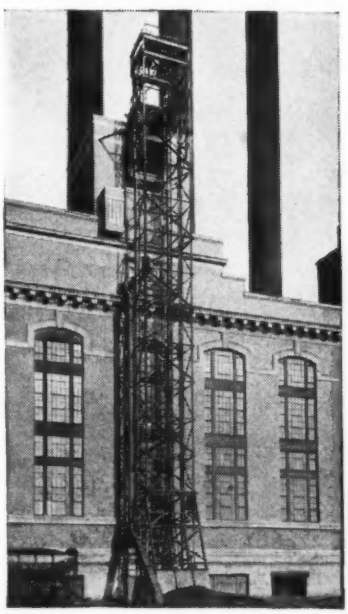
BRIDGEPORT BRASS

BRIDGEPORT BRASS COMPANY, BRIDGEPORT 2, CONN. • *ESTABLISHED 1865*



CENTRAL STATION COAL HANDLING

from receiving hopper to boiler



BARTLETT-SNOW central station coal handling is adapted to receiving coal by rail, over water-ways or by truck—and includes storage and reclaiming. Complete facilities are provided including belt, apron, reciprocating and duplex feeders; belt conveyors and belt trippers; crushers and breakers; skip hoists which are highly favored when space is limited—bins, bunkers and distributing conveyors, dust hooded and vented if desired. The equipment can be partially exposed to outside view, or entirely enclosed permitting the building to conform to any desired architectural style. Our long and specialized experience—proven design—and fixed unit responsibility are positive assurance of efficient, satisfactory operation. Send for Bulletin No. 83. It contains much information of interest to engineers and operating men.

THE C. O. BARTLETT & SNOW CO.

6205 Harvard Avenue, Cleveland 5, Ohio

Engineering and Sales Representatives in the Principal Cities

●

COAL HANDLING FOR CENTRAL STATIONS AND INDUSTRIAL BOILER PLANTS

Take a WALWORTH No. 225P Bronze Valve Apart...

COMPARE IT PIECE BY PIECE

It will pay you to look inside the Walworth No. 225P. Compare the improved design, construction and convenience features shown in the "exploded" view. Notice the husky bronze body, the removable seat and disc, the oversize stem, all assuring maximum protection against wear and leakage.

Further, No. 225P is the TOUGHEST bronze valve your money can buy. The stainless steel, noncorrosive seats and discs are heat treated to a hardness of 500 Brinell — hard enough to scratch glass and crush nails. For this reason, the valve can be closed on sand, slag, scale and similar flotage without injury to the seating surfaces, and "wire drawing" is practically eliminated. Thus years of tight, positive shut-off are assured.

Available in both globe and angle types (angle type: No. 227P) in sizes ¼" to 2", this quality valve is recommended for 350 lbs. W.S.P. at 550 F, and 1000 lbs. non-shock service on cold water, oil, gas or air.

For full data on this long-life, economical Walworth Bronze Valve, see your local Walworth distributor, or write for Circular 82.

WALWORTH

valves and fittings

60 EAST 42nd STREET, NEW YORK 17, N. Y.

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

THEY TAKE THE TURNS *faster*

A powerful, streamlined motor drives the Lagonda cleaner, with its whirling cutter head, through the toughest scale and around difficult tube turns. It's a "scale-killer" under any scale conditions, on all tubes—straight or curved.

A special lubrication system provides a continuous flow of oil to all necessary parts of air-driven motors, including the front bearing, so that longer life and trouble-free operation are assured. Water-driven motors are water lubricated. Rugged, heat-treated crown cutters chew up every bit of scale on the first bite. And "trackless" cutter teeth are spaced unevenly so as to avoid striking the same point as they revolve inside the tube.

Get all the facts about Lagonda 1300 and 2000 series cleaners for boiler tubes now. Illustrated bulletins available on request.

ELLIOTT COMPANY
Lagonda Division, SPRINGFIELD, O.
Plants at: JEANNETTE, PA. • RIDGWAY, PA.
SPRINGFIELD, O. • NEWARK, N. J.
DISTRICT OFFICES IN PRINCIPAL CITIES

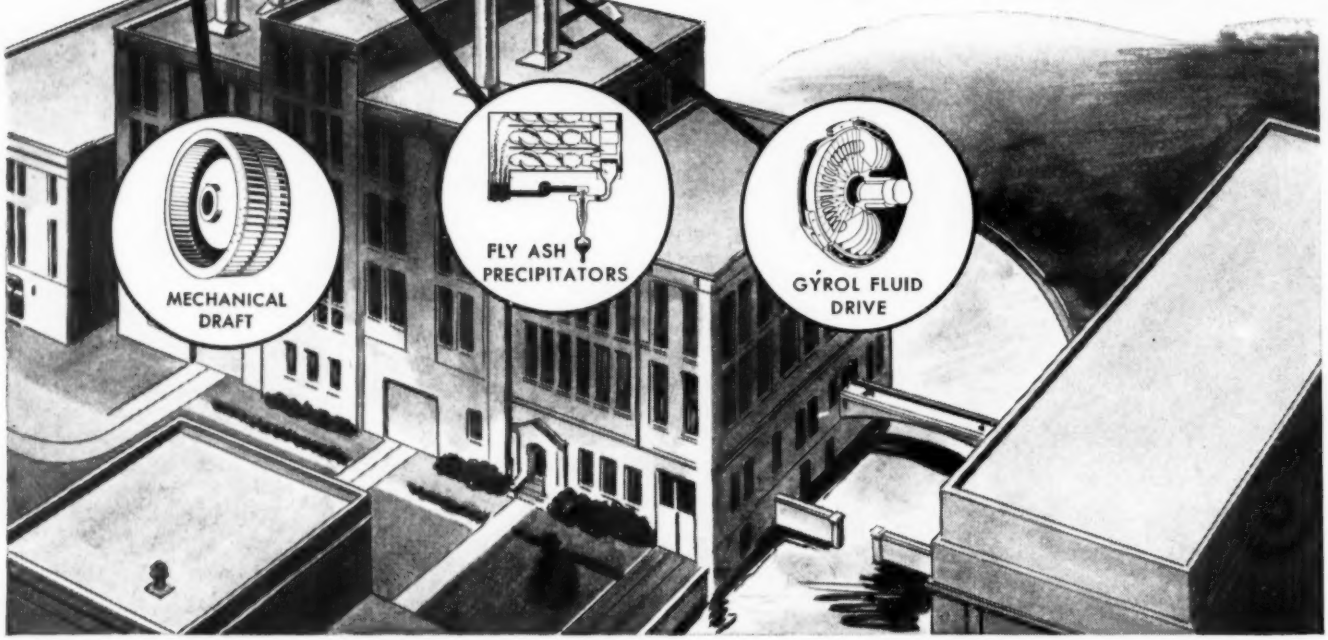
Lagonda TUBE CLEANERS

Y-263

3 essential items

1 source of supply

When plans call for a new power plant or modernization of an existing plant, investigate American Blower Mechanical Draft Fans, Fly Ash Precipitators and Gyrol Fluid Drive. You get undivided responsibility on these three essentials and a single source of technical information.



Buy all 3 from ABC

Mechanical Draft Fans are an essential for *every* power plant—*most* plants use Fly Ash Precipitators—and *more* and *more* plants are taking advantage of Gyrol Fluid Drives to provide stepless variable speed control on boiler feed pumps as well as on mechanical draft fans.

The word is going 'round, too, that American Blower is a splendid source for all three.

Because . . .

In each of these fields, American Blower gives you top engineering, research and manufacturing facilities. You are served by an engineer who is familiar with all three fields. The result is better power plant operation because responsibility is centralized in *one* qualified supplier—it's good business to *buy all 3 from ABC!*

Let us present the complete story of our services to power plants at your convenience. Just write, or phone, the nearest American Blower Branch Office. There is one nearby.

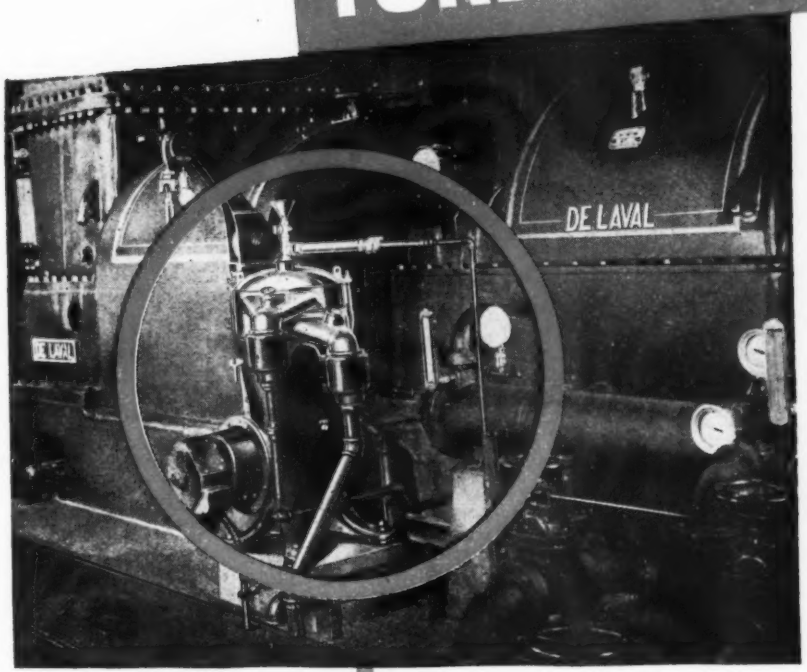
AMERICAN BLOWER

AMERICAN BLOWER

AMERICAN BLOWER CORP., DETROIT 32, MICH.

Division of American Radiator & Standard Sanitary Corporation

TURBINE PROTECTION



THAT DOES NOT STOP HALFWAY

DE LAVAL protection to a turbine goes the whole distance. It removes ***both*** contaminants—***dirt*** and ***water***—and keeps the lubricating oil at its best at all times.

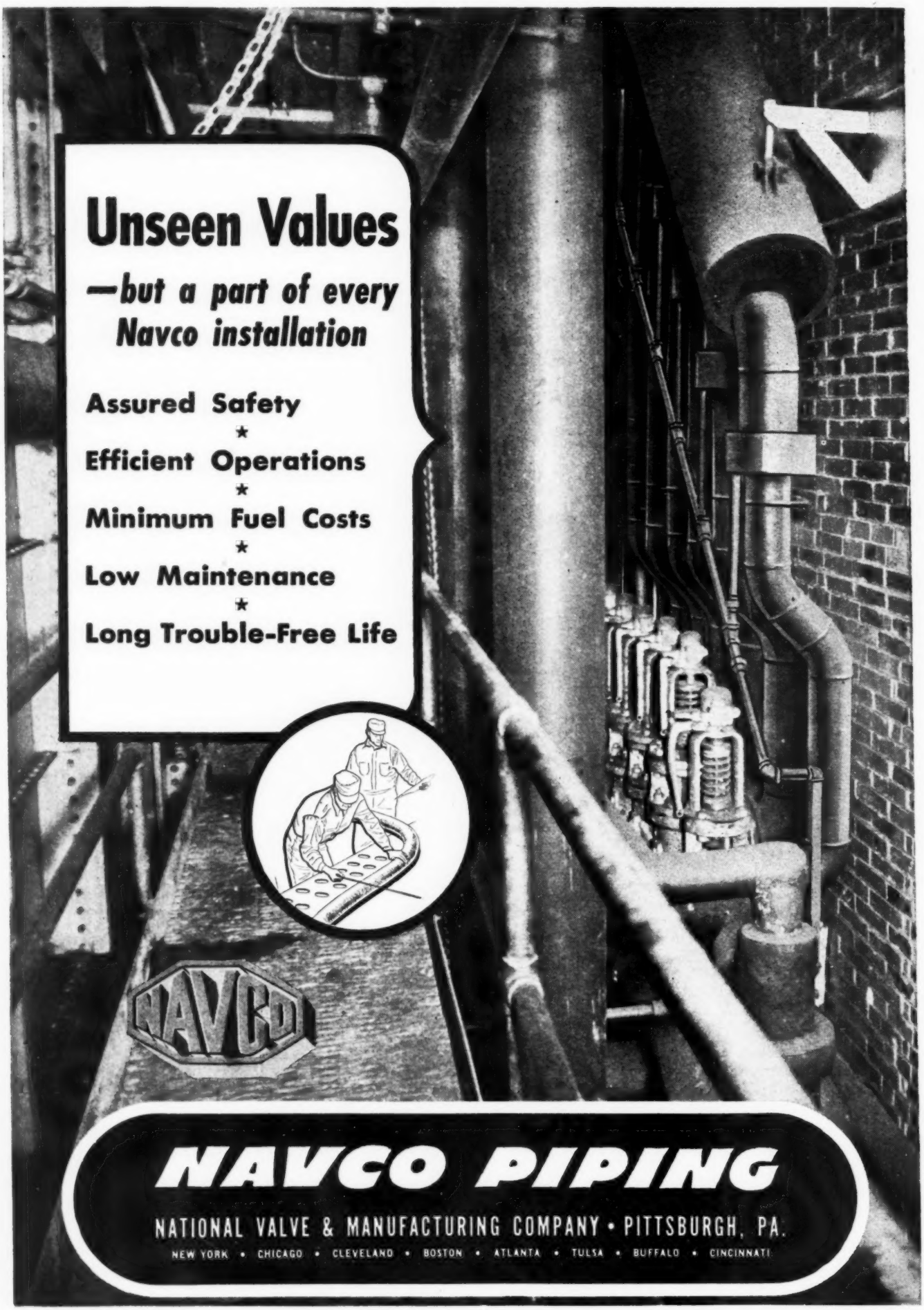
It is not sufficient to remove dirt only from turbine oil. While dirt obviously soon ruins oil as a lubricant, as often as not the chief offender in that respect is ***water.*** For water, either as condensate or as solid "slugs" leads directly to the formation of sludge. It is also apt to emulsify the oil and cause serious difficulty in that way.

De Laval Oil Purifiers, wholly mechanical in action, remove dirt and continuously discharge the water, effecting separation by centrifugal force. The machines maintain full efficiency of purification at all times, right to the moment when the bowl is full and must be cleaned.

THE DE LAVAL SEPARATOR COMPANY
165 Broadway, New York 6 427 Randolph St., Chicago 6
DE LAVAL PACIFIC CO., 61 Beale St., San Francisco 19
THE DE LAVAL COMPANY, Limited
MONTREAL PETERBOROUGH WINNIPEG VANCOUVER

DE LAVAL OIL PURIFIERS

FOR MORE DEPENDABLE POWER PRODUCTION

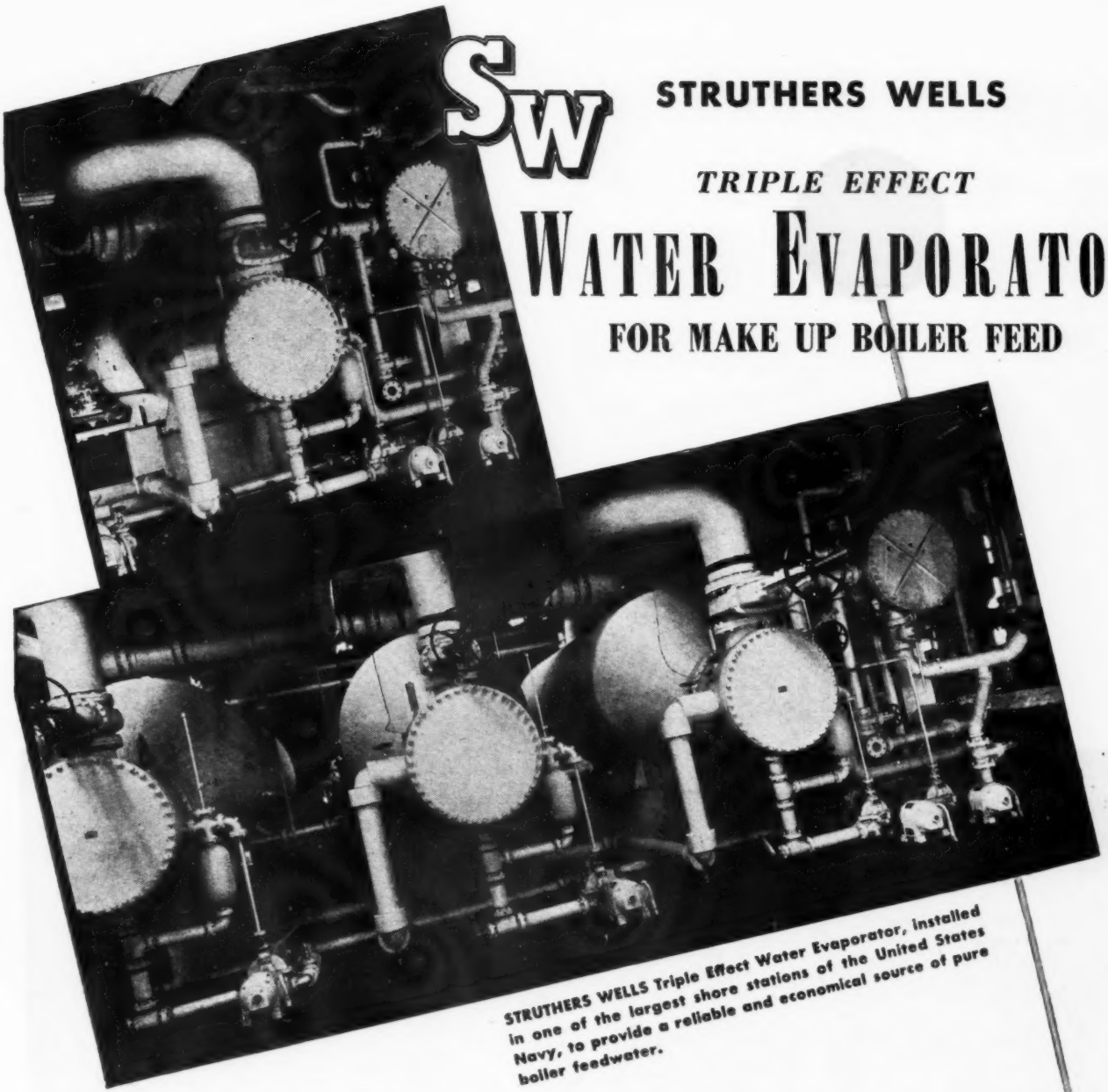

Unseen Values
—but a part of every Navco installation
Assured Safety
★
Efficient Operations
★
Minimum Fuel Costs
★
Low Maintenance
★
Long Trouble-Free Life
NAVCO
NAVCO PIPING
NATIONAL VALVE & MANUFACTURING COMPANY • PITTSBURGH, PA.
NEW YORK • CHICAGO • CLEVELAND • BOSTON • ATLANTA • TULSA • BUFFALO • CINCINNATI

SW STRUTHERS WELLS

TRIPLE EFFECT

WATER EVAPORATOR

FOR MAKE UP BOILER FEED



STRUTHERS WELLS Triple Effect Water Evaporator, installed in one of the largest shore stations of the United States Navy, to provide a reliable and economical source of pure boiler feedwater.

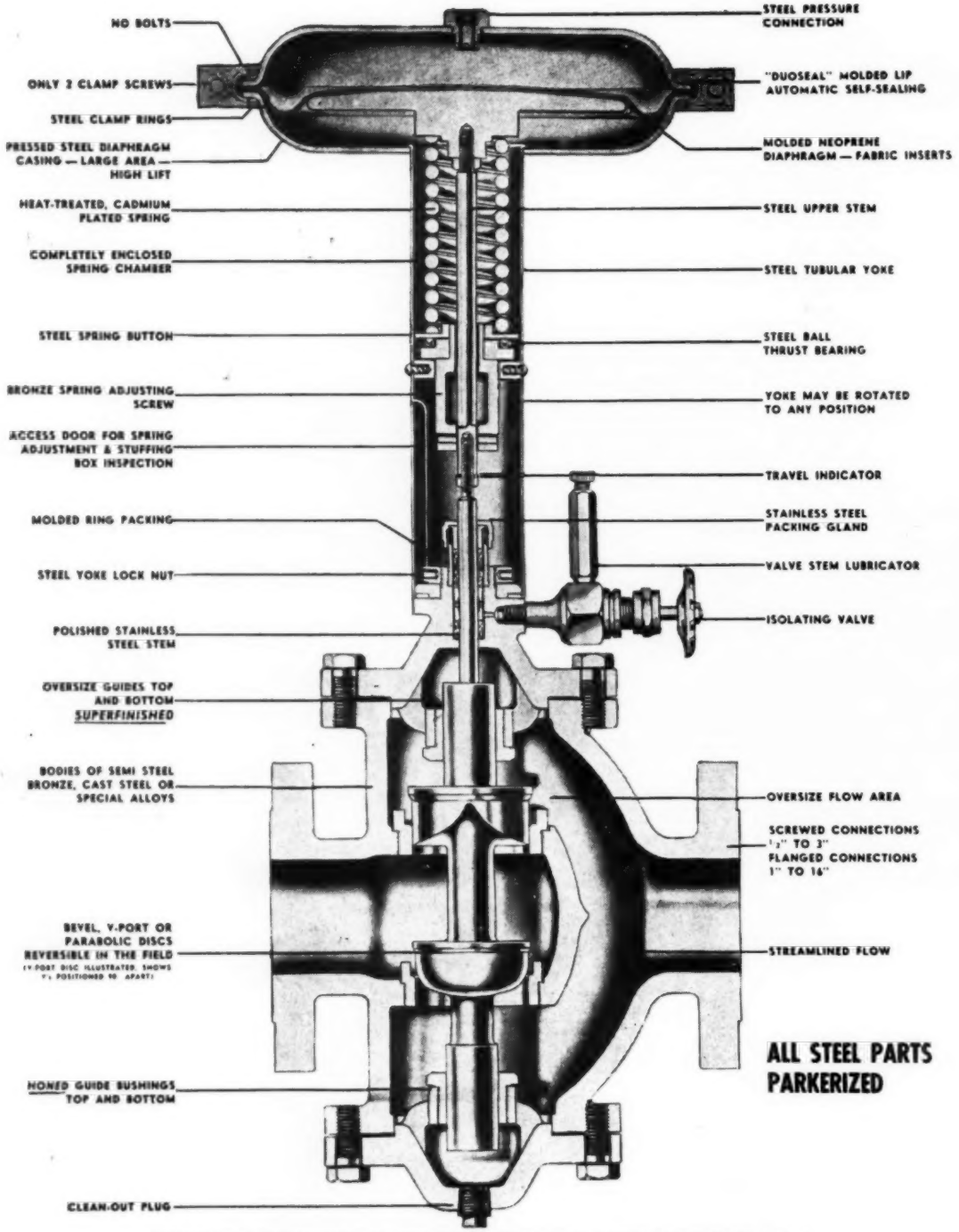
● Designed to operate on either fresh water or sea water feed, with provision for thermal descaling of tubes, and arranged to permit continued operation with one or more effects cut out, this installation has a normal rated capacity in excess of 100,000 gallons per day of pure distilled water.

In the modern power plant, STRUTHERS WELLS make-up evaporators provide sound basic design together with tried and proven improvements which assure a maximum of performance and a minimum of maintenance, making them fitting companions for STRUTHERS WELLS Feedwater Heaters.

STRUTHERS WELLS CORPORATION

PROCESS EQUIPMENT DIVISION • WARREN, PENNA.

PLANTS AT WARREN, PENNA. and TITUSVILLE, PENNA.


NO BOLTS
ONLY 2 CLAMP SCREWS
STEEL CLAMP RINGS
PRESSED STEEL DIAPHRAGM CASING — LARGE AREA — HIGH LIFT
HEAT-TREATED, CADMIUM PLATED SPRING
COMPLETELY ENCLOSED SPRING CHAMBER
STEEL SPRING BUTTON
BRONZE SPRING ADJUSTING SCREW
ACCESS DOOR FOR SPRING ADJUSTMENT & STUFFING BOX INSPECTION
MOLDED RING PACKING
STEEL YOKE LOCK NUT
POLISHED STAINLESS STEEL STEM
OVERSIZE GUIDES TOP AND BOTTOM SUPERFINISHED
BODIES OF SEMI STEEL BRONZE, CAST STEEL OR SPECIAL ALLOYS
BEVEL, V-PORT OR PARABOLIC DISCS REVERSIBLE IN THE FIELD
(V-PORT DISC ILLUSTRATED. SHOWS ¼" POSITIONED 90 APART)
HONED GUIDE BUSHINGS TOP AND BOTTOM
CLEAN-OUT PLUG
STEEL PRESSURE CONNECTION
"DUOSEAL" MOLDED LIP AUTOMATIC SELF-SEALING
MOLDED NEOPRENE DIAPHRAGM — FABRIC INSERTS
STEEL UPPER STEM
STEEL TUBULAR YOKE
STEEL BALL THRUST BEARING
YOKE MAY BE ROTATED TO ANY POSITION
TRAVEL INDICATOR
STAINLESS STEEL PACKING GLAND
VALVE STEM LUBRICATOR
ISOLATING VALVE
OVERSIZE FLOW AREA
SCREWED CONNECTIONS ½" TO 3"
FLANGED CONNECTIONS 1" TO 16"
STREAMLINED FLOW
ALL STEEL PARTS PARKERIZED

DIAPHRAGM MOTOR VALVES, PRESSURE REGULATORS, PUMP GOVERNORS, ETC.

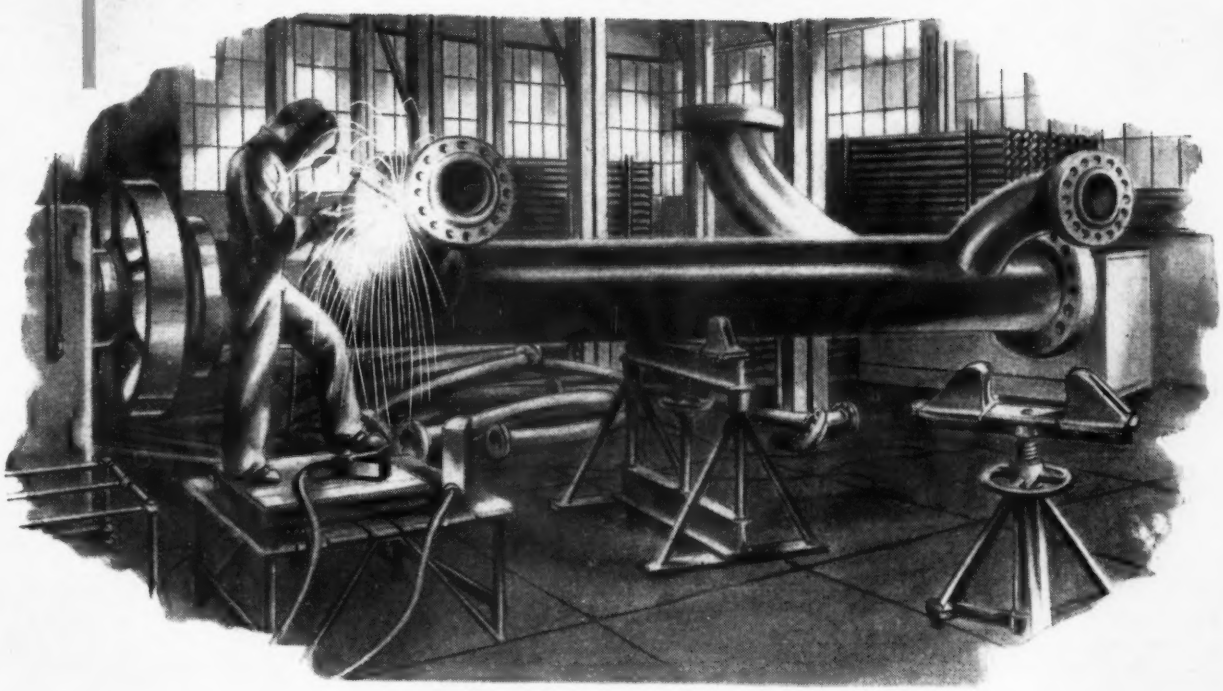
SOMETHING NEW HAS BEEN ADDED

Write for new Kontrol Motor bulletin. Send us your control problems.

KONTROL KIELEY & MUELLER MOTOR

KIELEY & MUELLER, INC., North Bergen, N. J.

SHOP WELDING of Pressure Piping has Important Advantages



Welding of pressure piping in the shop of a qualified pipe fabricator has many advantages which are difficult to duplicate in the field.

The great volume of pressure welding done in the plant of the fabricator gives *continuous* employment to large numbers of qualified welders—this day-after-day welding means that the hand never loses its skill. The welders are provided with a wide variety of work rotating fixtures for position welding under the most favorable conditions for both quality and production. Other facilities (usually superior in the shop) that have a direct bearing on the quality of welded piping include equipment for accurate layout, correcting alignment, stress relieving, cleaning and testing.

In the fabricating plant, it is much easier to exercise close and continuous supervision over all welders . . . to make certain that approved procedures are exactly followed in every detail.

Better welding is just one of the reasons why prefabricated piping by qualified fabricators is better piping.

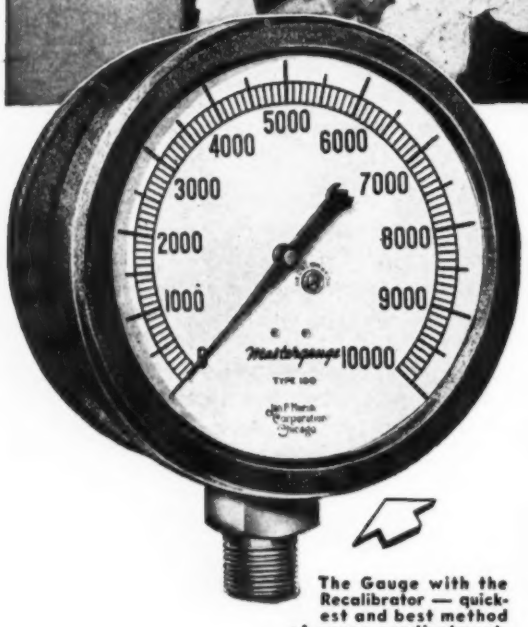
THE PIPE FABRICATION INSTITUTE

1108 CLARK BUILDING, PITTSBURGH, PA.

DEVOTED TO THE TECHNICAL AND ECONOMIC PROBLEMS IN PIPING

G-4

You can't beat facts
World's Highest-Pressure Well Gages 8,225 Pounds
by E. H. Short, Jr.
An interesting angle to this record-pressure producer: Adding the weight of the 11,000-ft. gas column to the surface recording, the bottom-hole pressure may be fairly close to 10,500 psi.
WHEN the christmas-tree gage-valve was opened on Glenn H. McCarthy's recently completed well in the Blue Lake field, Brazoria County, Texas, the hand flipped around to 8,225 psi., indicating the highest-pressure well ever encountered. It also signaled a tribute to the field men in charge who completed the well without unusual trouble. A historical review of the past record-breaking oil, gas, and high-pressure wells is punctuated with unpreparedness for the unusual conditions encountered; such conditions often resulting in fire, blowout, or the wild flow of oil and gas on the surrounding countryside. Quick thinking, and coordinated team work on the part of the especially trained McCarthy drilling crew prevented a blowout at 10,992 ft. when the well kicked 15½ lb. drilling mud. Within a little less than 5 minutes from the time the well kicked, closing-in operations were completed
This well, McCarthy 1 Holland, John E. Ackley Survey, is located approximately 8 miles west of Angleton, Texas. This is about 40 miles south of Houston. Drilling was commenced in December 1945 and the well was completed during the middle of April 1946. The open-flow potential was placed at 300,000,000 cu. ft. per day. No estimate has been made as to the volume of condensate the well will produce when completely hooked up.



The Gauge with the Recalibrator — quickest and best method of gauge readjustment.

• Reproduced here is a page from May 4 Oil & Gas Journal which tells the dramatic story of the world's highest-pressure oil well. It takes a real gauge to withstand pressure up in the 8000 pound range and indicate it properly. So it's not surprising that the gauge chosen for this tough assignment was the Marsh Mastergauge.

In the Marsh Mastergauge with its lathe turned and reamed bourdon tube and its advanced monel and stainless steel movement, industry has found a gauge equal to any conceivable operating condition . . . . whether it is extreme pressure, pressure surge, vibration, or a combination of them all! Its wide use in the petroleum industry, so well exemplified by this extremely critical application, is unassailable proof of this.

Whatever your gauge requirements, you just can't get away from facts like these. Your gauge requirements may not involve conditions calling for the Mastergauge. But when you use the type of Marsh Gauge adapted to your service, you have the reassurance of using the product of a manufacturer whose gauges have become first choice for the most critical applications.

JAS. P. MARSH CORPORATION, 2075 Southport Ave., Chicago 14, Ill.

MARSH GAUGES

"THE STANDARD OF ACCURACY"

TOUGH LOADS . . . RIGHT ANGLE FEED . . .

LICKED BY BWH CONVEYOR BELT!

Far below ground, a BWH Conveyor Belt, under extremely difficult conditions, licked the problems posed by this Pennsylvania Coal mining operation. Used as a "gathering conveyor," it picked up the discharge from other room conveyors and brought the coal to the cars. This operation involved tandem drive, right angle feed, and uneven distribution of load. Yet this belt . . . produced by the exclusive BWH ROTOCURE process of continuous vulcanization . . . did the job, and did it well!

This "know how" in producing conveyor belts of extraordinary toughness is one reason why BWH is known throughout industry for its achievements in producing industrial rubber goods of dependable ruggedness. Perhaps you've a problem we can solve for you.

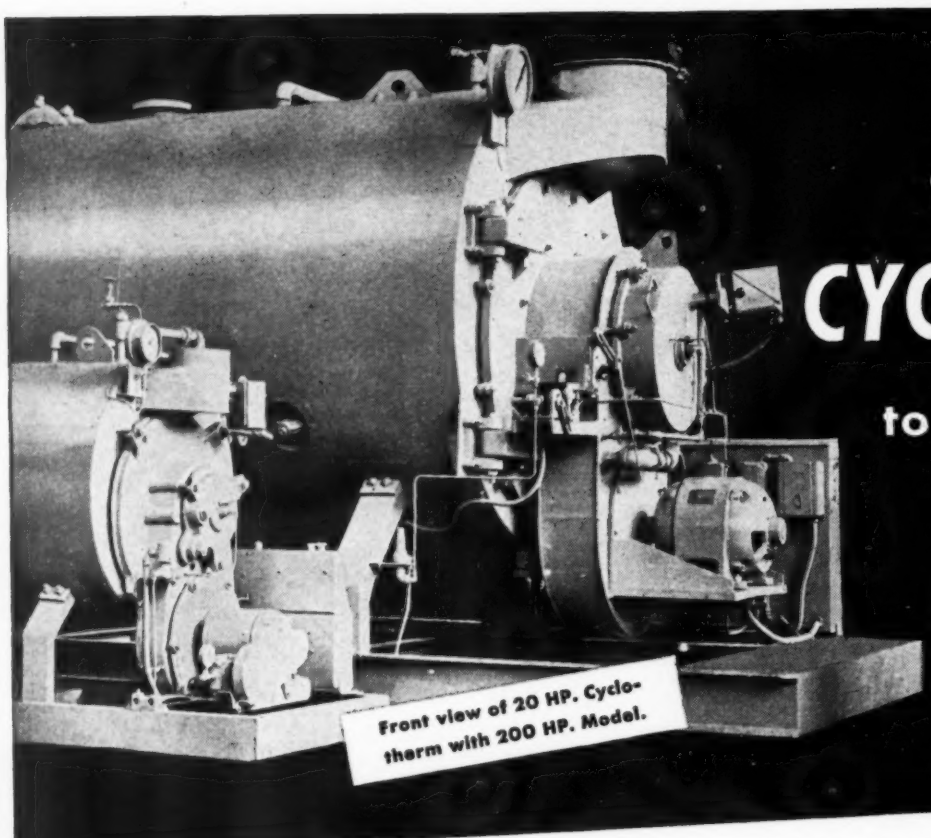
HAVE YOU A JOB WHERE STAMINA COUNTS?

Bring us your toughest problems . . . we're specialists in solving them. Consult your nearest BWH distributor, or write to BWH direct.

BOSTON WOVEN HOSE & RUBBER COMPANY

Distributors in All Principal Cities

WORKS: CAMBRIDGE, MASS., U. S. A. • P. O. BOX 1071, BOSTON 3, MASS.



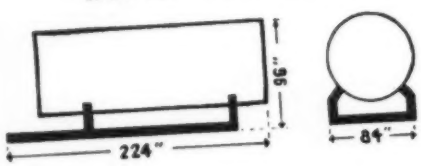
Front view of 20 HP. Cyclotherm with 200 HP. Model.

There is a CYCLOTHERM to meet every need for STEAM

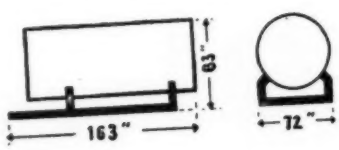
Note these favorable "go thru" dimensions

Cyclotherm steam generators are manufactured in convenient sizes from 10 to 200 HP and with operating pressure from 15 to 200 psi. A Cyclotherm may be installed anywhere and functions without special foundation or stack.

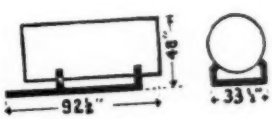
200 H. P. MODEL



100 H. P. MODEL



20 H. P. MODEL



Designed for highest efficiency with minimum operating and maintenance expense

Whatever your use of steam, there is a dependable Cyclotherm to do your job — and do it economically.

Initial cost and installation expense are low. Cyclotherm units are complete steam generating plants and are delivered to your door ready to operate on arrival.

Cyclotherm will minimize your operating and maintenance expense. The Cyclotherm exclusive method of combustion and heat transfer assures you of the highest operating efficiency. Simplified two-pass design makes maintenance problems easy. Larger sizes have hinged front assembly and rear door making tubes and furnace readily accessible.

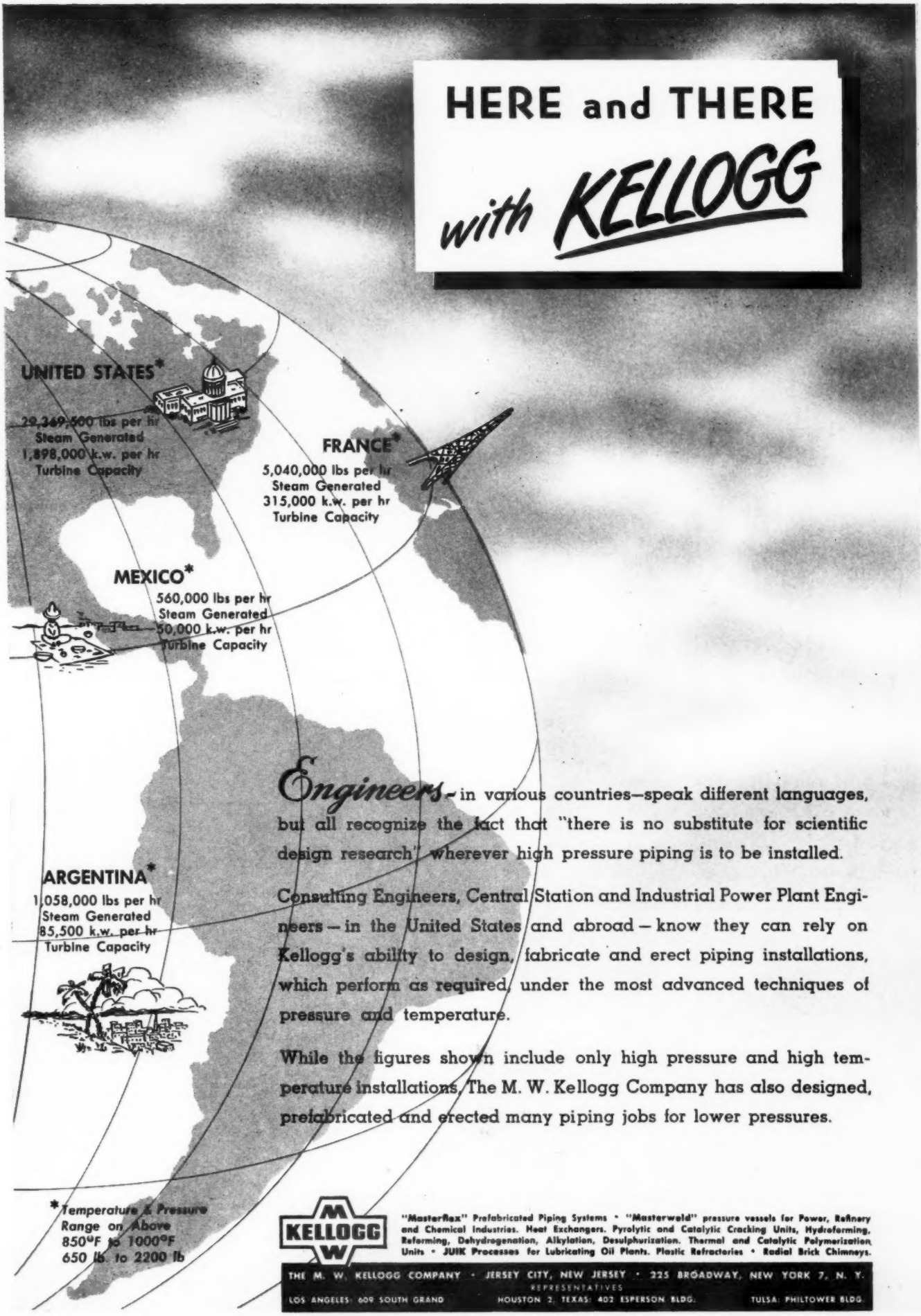
Cyclotherm is manufactured in convenient sizes from 10 to 200 HP and with operating pressures from 15 to 200 psi. Units may be fired with any liquid or gaseous fuel and all operation is fully automatic. Heavy oil operation available in sizes 50 to 200 HP with automatic modulating controls. All sizes are also available with the Cyclotherm special combination burner arrangement to fire either oil or gas.

Wire, write or phone for more information

CYCLOTHERM STEAM GENERATORS

CYCLOTHERM CORPORATION, 90 BROAD STREET, BOX 202, NEW YORK 4, N. Y.

HERE and THERE with KELLOGG



Engineers—in various countries—speak different languages, but all recognize the fact that "there is no substitute for scientific design research" wherever high pressure piping is to be installed.

Consulting Engineers, Central Station and Industrial Power Plant Engineers—in the United States and abroad—know they can rely on Kellogg's ability to design, fabricate and erect piping installations, which perform as required, under the most advanced techniques of pressure and temperature.

While the figures shown include only high pressure and high temperature installations, The M. W. Kellogg Company has also designed, prefabricated and erected many piping jobs for lower pressures.

KELLOGG

"Masterflex" Prefabricated Piping Systems • "Masterweld" pressure vessels for Power, Refinery and Chemical Industries. Heat Exchangers. Pyrolytic and Catalytic Cracking Units, Hydroforming, Reforming, Dehydrogenation, Alkylation, Desulphurization. Thermal and Catalytic Polymerization Units • JUIK Processes for Lubricating Oil Plants. Plastic Refractories • Radial Brick Chimneys.

THE M. W. KELLOGG COMPANY • JERSEY CITY, NEW JERSEY • 225 BROADWAY, NEW YORK 7, N. Y.

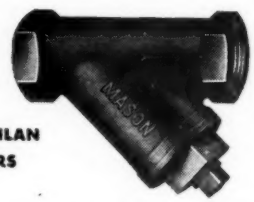
REPRESENTATIVES

LOS ANGELES: 609 SOUTH GRAND HOUSTON 2, TEXAS: 402 ESPERSON BLDG. TULSA: PHILTOWER BLDG.

Mr. Pennypincher Has a Rival In MASON No. 11 Reducing Valves

When it comes to controlling steam pressures, you'll find that Mason No. 11 reducing valves provide accurate, dependable pressure control under all conditions normally encountered. Their sturdy construction and simple operating mechanism not only save you money by reducing waste but provide long life and cut maintenance costs as well.

Write for Catalog 75. It gives complete information on the Mason No. 11 as well as other types of Masoneilan reducing valves and regulators.



MASONEILAN STRAINERS

Prevent scale, dirt chips, etc. from damaging regulator, traps, valves and pumps with Masoneilan strainers. They eliminate maintenance delays and save money.

MASON-NEILAN REGULATOR CO.

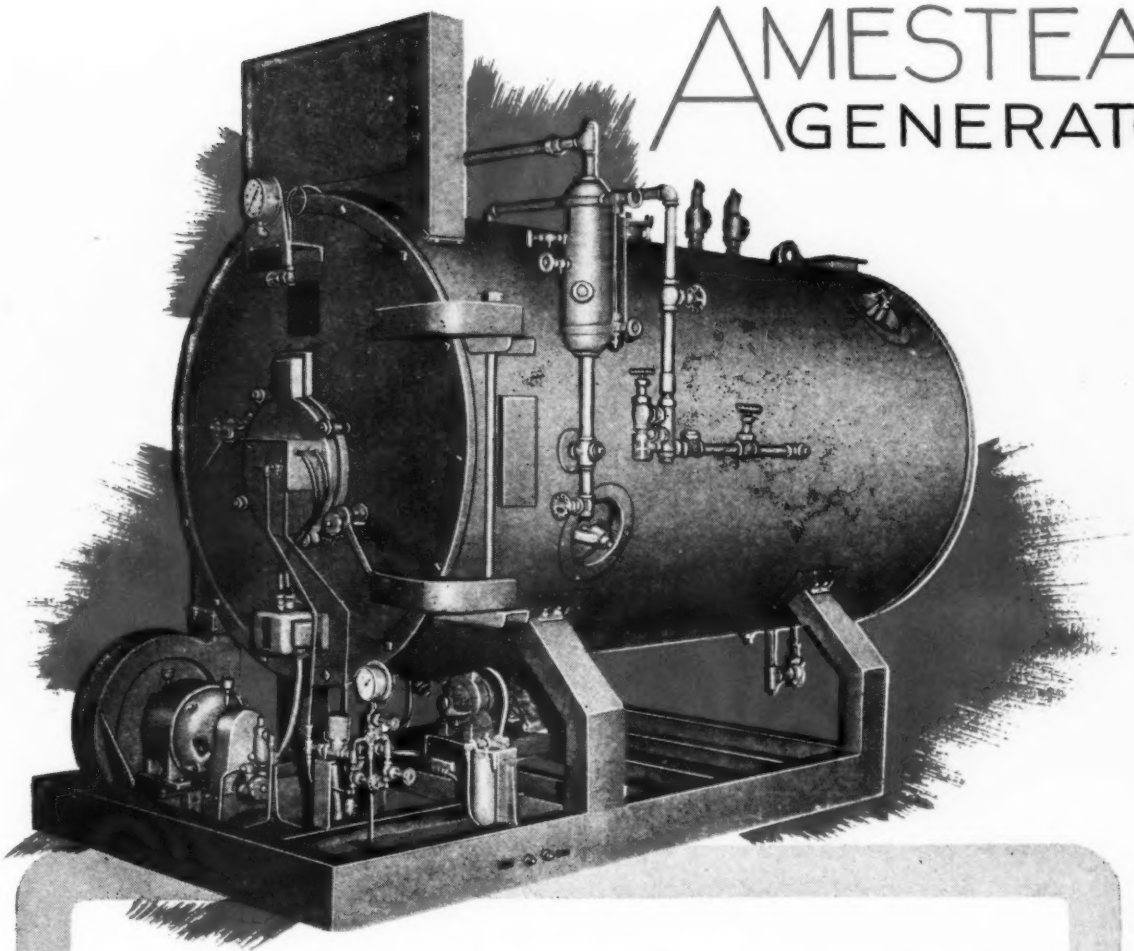
1186 ADAMS STREET, BOSTON 24, MASS., U. S. A.

MASONEILAN

New York Philadelphia Pittsburgh Cleveland Chicago Tulsa Atlanta
St. Louis Houston Los Angeles San Francisco Mason Regulator Co. of Canada, Ltd., Montreal, Canada

P. O. 7328

CAN YOU AFFORD NOT TO BUY AN AMESTEAM GENERATOR



Each unit is complete, ready to be attached to your steam, water, fuel and electric lines. No special foundations are required, the stack required need only be of sufficient length to exhaust the products of combustion outside the boiler room.

Every unit is tested in our shops before shipment. The fuel used and the conditions under which the unit is tested will approximate as closely as possible those under which it will operate in your plant.

The AMESTEAM Generator is built in sizes from 10 to 300 H.P. and pressures from 15# to 200#. Equipment is available for the use of any standard grade fuel oil or gas.

Let us offer you the economical solution to your steam generating needs.

A complete return-to-the-boiler system, including Feed Water Pump and Condensate Tank with their accessories, is part of the standard equipment with every standard AMESTEAM Generator.

AMES IRON WORKS

BOX B9 · OSWEGO · NEW YORK

Large 350-ton Bucyrus walking dragline powered by one 6 cylinder Cooper-Bessemer Diesel which is direct-connected to the walking mechanism and dragline. It also drives a generator for all electrical requirements including motor drive of boom.

In Paul Bunyan's Coal Shovel...

a Cooper-Bessemer Diesel proves its stamina

THIS 350-ton giant, a walking dragline that takes seven-foot strides, could easily qualify as Paul Bunyan's coal shovel. Forty-five feet high, with a 160-foot reach and a 6-cubic-yard bite, it has been scraping up as much as 1,000 tons per day for the past two years in a western Pennsylvania strip mining operation.

Power for walking as well as digging comes from one six-cylinder Cooper-Bessemer Diesel. It is one of the most gruelling types of service known to engines.

However, routine checkups have shown surprisingly little wear of major engine parts. Main bearings have remained in excellent shape. Crankpins have shown no sign of scratching. Cylinder liners have stayed smooth, clean and round. Pistons and rings are practically like new. In short, here is a consistent record of true stamina and outstanding performance.

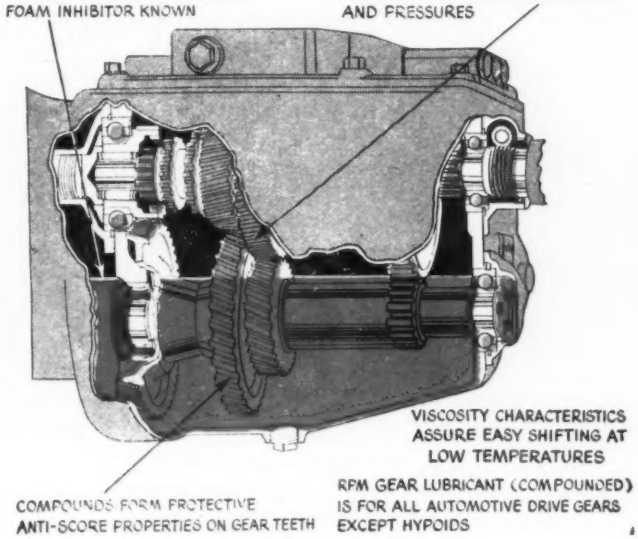
This engine's year-after-year reliability adds to a mountain of proof that you can always count on rugged Cooper-Bessemers for exceptionally long life and continuous trouble-free operation.

The
Cooper-Bessemer
Corporation

MOUNT VERNON, OHIO — GROVE CITY, PENNA.

NEW YORK · WASHINGTON · TULSA
DALLAS · ST. LOUIS · HOUSTON
LOS ANGELES · SEATTLE · SHREVEPORT

STANDARD ENGINEERS NOTEBOOK


RPM GEAR LUBRICANT (COMPOUNDED) CONTAINS THE MOST EFFECTIVE FOAM INHIBITOR KNOWN
RPM GEAR LUBRICANT (COMPOUNDED) RESISTS HIGH GEAR TEMPERATURES AND PRESSURES
VISCOSITY CHARACTERISTICS ASSURE EASY SHIFTING AT LOW TEMPERATURES
COMPOUNDS FORM PROTECTIVE ANTI-SCORE PROPERTIES ON GEAR TEETH
RPM GEAR LUBRICANT (COMPOUNDED) IS FOR ALL AUTOMOTIVE DRIVE GEARS EXCEPT HYPOIDS

Compounded lubricant prevents gear scoring

Many operators of automotive equipment have eliminated transmission and differential trouble by switching to RPM Gear Lubricant (Compounded). It is recommended for all transmissions and all conventional differentials. (RPM Hypoid Lubricant should be used in hypoid differentials.)

The compounds in RPM Gear Lubricant assure that a tough, oily film will remain on gears when pressure and heat become excessive. A highly effective foam inhibitor prevents retention of air in lubricant, poor distribution and "boiling up" to cause leaks.

RPM Gear Lubricant (Compounded) is non-corrosive. It comes in four grades: SAE 80, 90, 140, 250.

For complete information about automotive drive gears and their lubricants, write for the new, free booklet: "The Lubrication of Automotive Gears."

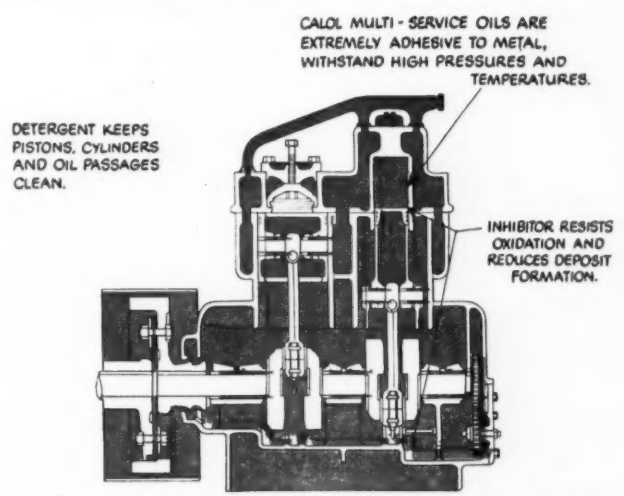
Multi-use oils resist high temperatures, pressure

Many of the industrial bearings and machines that operate at high temperatures and under extreme pressures can be efficiently lubricated with Calol Multi-Service Oils.

They are specially compounded. An oxidation inhibitor prevents the formation of excessive gum and sludge deposits. A detergent gradually loosens and removes lacquer or other contaminants from moving parts and oil systems. Calol Multi-Service Oils have a high metal-adherent quality and actually cling to the hottest spots.

Calol Multi-Service Oils have a wide use range. They are especially recommended for air-compressor cylinders and bearings, Diesel and natural gas engines, inclosed reduction gears and bearings.

They come in six viscosity grades: Number 45X is approximately SAE 10; number 50X, SAE 20 (medium); number 55X, SAE 20 (heavy); number 65X, SAE 30; number 75X, SAE 40; number 85X, SAE 50.


CALOL MULTI-SERVICE OILS ARE EXTREMELY ADHESIVE TO METAL, WITHSTAND HIGH PRESSURES AND TEMPERATURES.
DETERGENT KEEPS PISTONS, CYLINDERS AND OIL PASSAGES CLEAN.
INHIBITOR RESISTS OXIDATION AND REDUCES DEPOSIT FORMATION.

TWO-STAGE, 2-CYLINDER AIR COMPRESSOR.

CALOL MULTI-SERVICE OILS HAVE WIDE USE RANGE FOR HOT-RUNNING INDUSTRIAL BEARINGS.

For additional information and the name of your nearest Distributor, write Standard of California, 225 Bush Street, San Francisco 20, Calif.; The California Oil Company, 30 Rockefeller Plaza, New York 20, N. Y.; The California Company, 17th and Stout Streets, Denver 1, Col.; Standard Oil Company of Texas, El Paso, Texas.

FOR EVERY NEED A STANDARD OF CALIFORNIA JOB-PROVED PRODUCT

R/M tadpole tape is designed to provide a tight seal on furnace doors and in applications where heat-resistance is important, but flange pressure is not great.

The packing consists of a soft core of asbestos with a wire-inserted asbestos cloth folded over the exterior. It is impregnated with a special binder, selected for its heat-resisting quality, and the typical tadpole-like cross-section is the result of the cloth extending to one side. This forms a flange for riveting or securing the gasket, yet leaves the round portion as a cushion upon which the door or cover closes.

Whatever your packing requirements, your authorized R/M distributor can supply the one R/M packing that is specially engineered to do the job.

RAYBESTOS-MANHATTAN, INC.

Manheim, Pa. • Bridgeport, Conn. • North Charleston, S. C. • Passaic, N. J.

It's "Packed with Satisfaction" when you use R/M

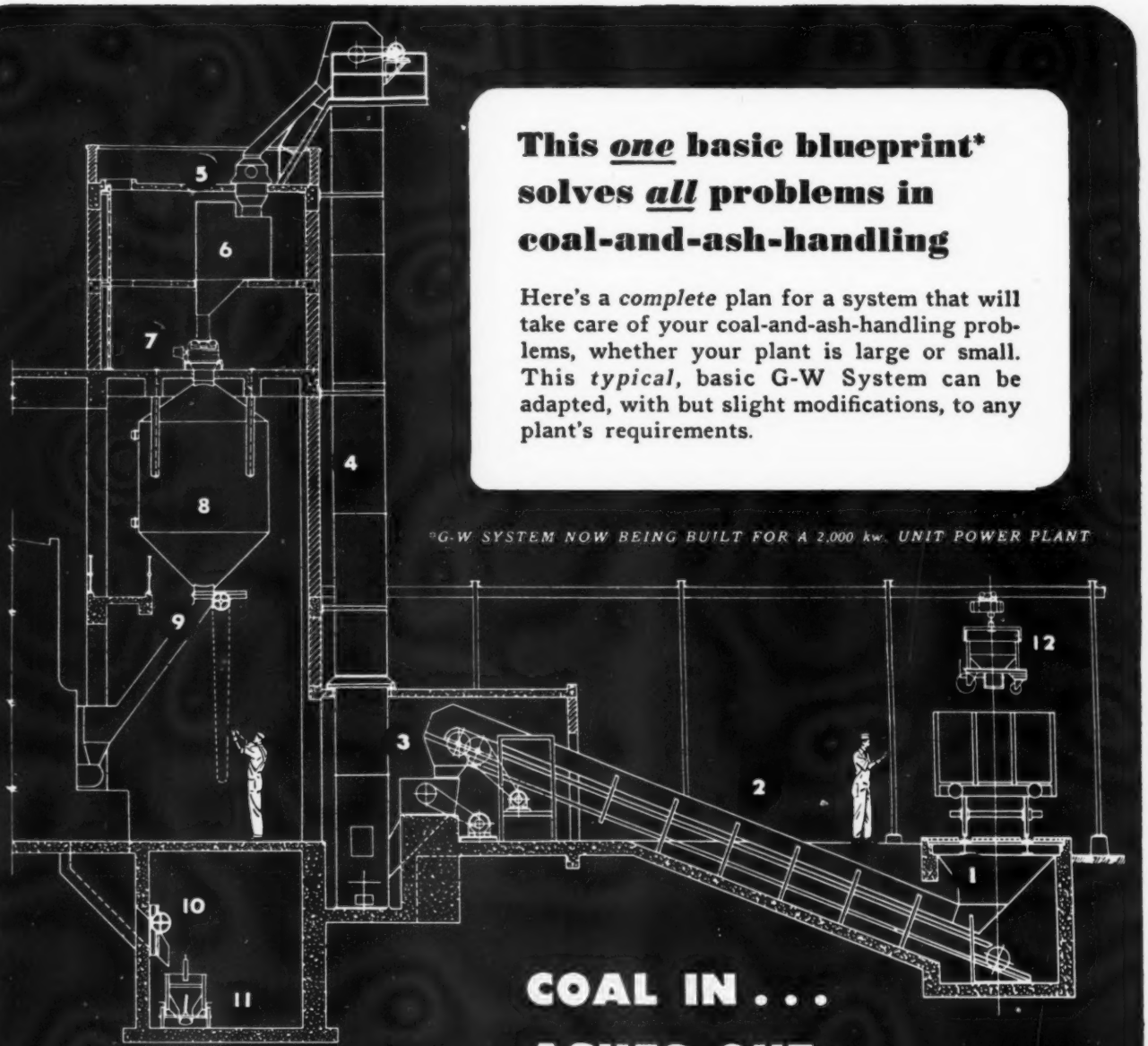
RAYBESTOS R M MANHATTAN

R M

This *one* basic blueprint* solves *all* problems in coal-and-ash-handling

Here's a *complete* plan for a system that will take care of your coal-and-ash-handling problems, whether your plant is large or small. This *typical*, basic G-W System can be adapted, with but slight modifications, to any plant's requirements.

*G-W SYSTEM NOW BEING BUILT FOR A 2,000 kw. UNIT POWER PLANT



COAL IN . . .
ASHES OUT

1. Coal passes through *Grating, Hopper* and *Control Gate* to feeder pans.
2. *Apron Feeder* draws coal from hopper, conveys it at uniform rate to crusher.
3. *Crusher* delivers stoker-sized coal to elevator boot.
4. *Bucket Elevator* discharges coal to surge hopper.
5. *Surge Hopper Control Unit* assures constant supply to scale.
6. *Scale* automatically weighs, records and discharges to shuttle belt conveyor.
7. *Shuttle Belt Conveyor* serves several bins from central weighing point.
8. *Storage Bins* have coal level control.
9. *Control Gate* and *Spout* to stoker.
10. *Ash Unloading Gate.*
11. *Ash Cart* manually operated through tunnel.
12. *Ash Cart* electrically operated for ash disposal.

G-W HANDLES IT . . .
faster • easier • cheaper

SINCE 1814

1723

CANTON STOKERS score highe

Ithaca Gun Company INCORPORATED

TELEPHONE 3 3 0 1

Geo. Livermore, President
L. P. Smith, Vice-President
Paul S. Livermore, Treasurer
Mel. Sheldon M. Smith, Secretary

ITHACA, N. Y.

April 2, 1946.

Canton Stoker Corp.
204 State Tower Bldg.,
Syracuse, New York.

Gentlemen:

Attention: Joseph W. Miller

At the suggestion of our maintenance department we have consulted our records and find the following in connection with the operation of the Canton Automatic Stoker which you installed for us some time ago:

For the period from May 24, 1945 to March 24, 1946 we used approximately 1123 tons of buckwheat coal. The same period 1944 to 1945, we used 1189 tons of buckwheat coal and the heating period just prior to the installation of your stoker we used 1260 tons of rice coal. You will see by this that the first year our stoker was in operation our consumption of coal went down considerably and this was one of the most severe winters we have had in some time. It may also be noted that during the heating season which we have just passed through we have enjoyed an additional saving when you compare it with the last season the boiler was fired by hand. It is quite possible that this additional saving in the past season has been helped by the fact that we have installed a much higher smoke stack as recommended by your engineers and have installed additional Canton equipment such as a draft and stack temperature control, which evidently has added to the efficiency of our boiler operation.

The maintenance on this unit since its installation has been practically nothing, with the exception of the replacement of one pressure control switch and since the time of installation our stoker has not been out of commission for one hour due to mechanical breakdown.

We trust that this information will be of interest to your company.

Very truly yours,
ITHACA GUN COMPANY, INC.

E. H. Young,
Purchasing Agent

EHY:ekm

FUEL ECONOMY

ENGINEERIN SERVICE

MINIMUM MAINTENAN COST

DEPENDABIL

....WORLD'S RECORD 1404 TARGETS WITHOUT A MISS WITH AN ITHACA GUN

...or Ithaca Gun!

TARGET FOR TODAY is *your* heating plant. You want to burn as little coal as possible now because of higher fuel costs—Right? You want trouble-free performance; equipment engineered to meet and solve your own individual problems; and equipment that is rugged—does not break down or fail when you need it most. Because of higher labor costs, you also want an automatic stoker-fired heating plant.

That plus a FIVE YEAR GUARANTEE is exactly what you get when you buy any one of the several sizes and types of Canton Ramfeed Stokers. The Canton Stoker Corp. is the *only* manufacturer who gives you such a guarantee against defects and wear. (Our confidence comes from the great record Canton Stokers have made for themselves everywhere in all kinds of installations.

Canton Stokers offer these "extras"

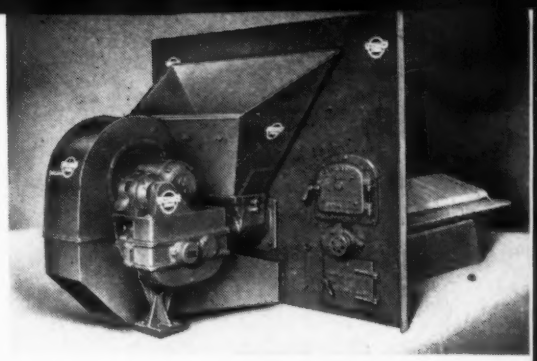
- Fully synchronized combustion control.
- Fin-cooled and more durable furnace assemblies.
- Fan flexibility—side, rear, or front settings with unit or separate motor drives.
- Engineered to burn Bituminous, Semi-Bituminous, and Anthracite coal, or combination wood and coal.
- Installation by a Factory Engineer.

Today's higher fuel and labor costs make Canton Stoker savings more important than ever. Get the facts on this reliable, money-saving stoker NOW. Let a Canton engineer survey your requirements and give his recommendations at absolutely no cost to you. Just fill in the coupon, attach to your letterhead, and mail.

CANTON
stokers

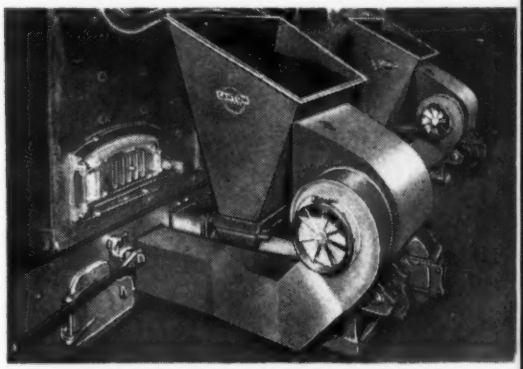
CANTON STOKERS

741 Andrews Place S. W., Canton, Ohio



VULCAN INDUSTRIAL RAMFEED STOKER

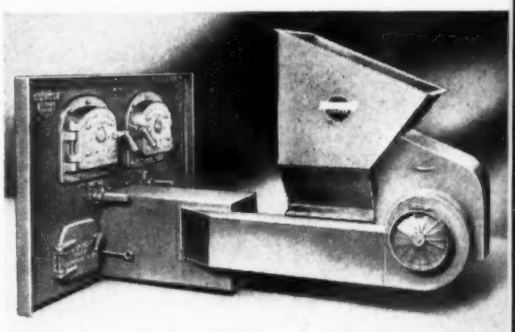
▶ 18 sizes and types designed to carry the heaviest loads. Equipped with uniflex drive, the Vulcan fits in small, limited spaces. Easy accessibility with oversize doors and clean out panel. Gear operated side ash dumping plates. Ramfeed design permits rapid installation.



LO-SET INDUSTRIAL RAMFEED STOKER

▶ Engineered for firing efficiency in medium industrial and heavy commercial applications. 18 sizes and types. Use very little power because of gear reduction design.

Sizes are built for any steam demand from 50 to 400 developed Boiler H. P. Side ash dumps, ash sprays, low water Safety Cutouts, and Overfire Air Systems are available with all sizes.



DURAFLEX WORMFEED STOKER

▶ 10 sizes and types for lighter industrial and medium commercial demands, from 10 to 150 Boiler H. P. Available with side ash dumps or dead plates.

CANTON STOKER CORP., 741 Andrews Pl. S. W., Canton, Ohio

Gentlemen: Please send me the bulletins checked below at once.

- ☐ No. 203 Vulcan (Industrial Heavy Duty)
- ☐ No. 400 Lo-Set Heavy Duty
- ☐ No. 500 Duraflex (Light Industry and Commercial)
- ☐ Have a Canton Engineer see us immediately.

Name .....

Company .....

Address .....

City ..... *Zone* .... *State* .....

THEY CAN'T STRIKE YOU OUT!

Peabody Combined Burners bring you production assurance . . . and bring to your employees a feeling of security which they are quick to appreciate.

Peabody Combined Burners eliminate shutdowns resulting from dependence upon a single fuel . . . and assure uninterrupted service by their plus of reliable performance through advanced design and engineering "know-how", born of long experience. Ask for a Peabody engineer to help you solve your combustion problems.

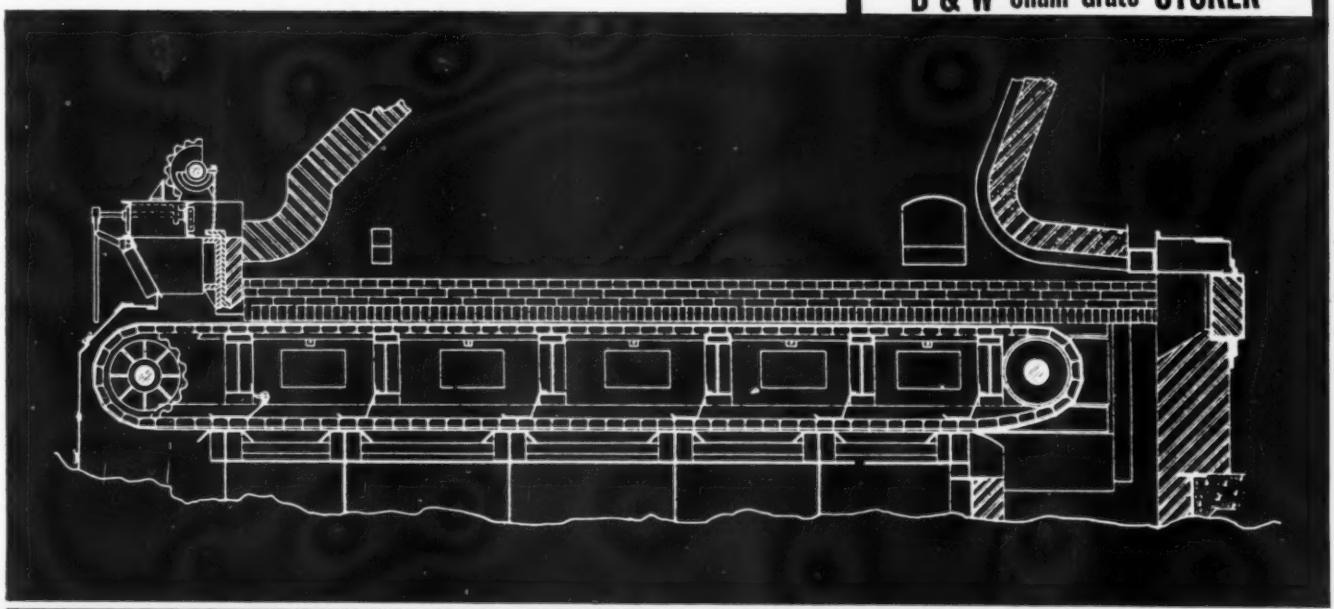
PEABODY

580 FIFTH AVENUE • NEW YORK CITY

OFFICES IN PRINCIPAL CITIES

WALL BRICK DATA

B & W Chain Grate STOKER



Plan to get more Low Cost Steam

This Chain Grate Stoker is designed and constructed by Babcock & Wilcox to perform at top efficiency. Its operation, particularly at maximum demand is materially aided by the installation of CARBOFRAX silicon carbide brick in the clinker zone. More low cost steam with less trouble is obtained.

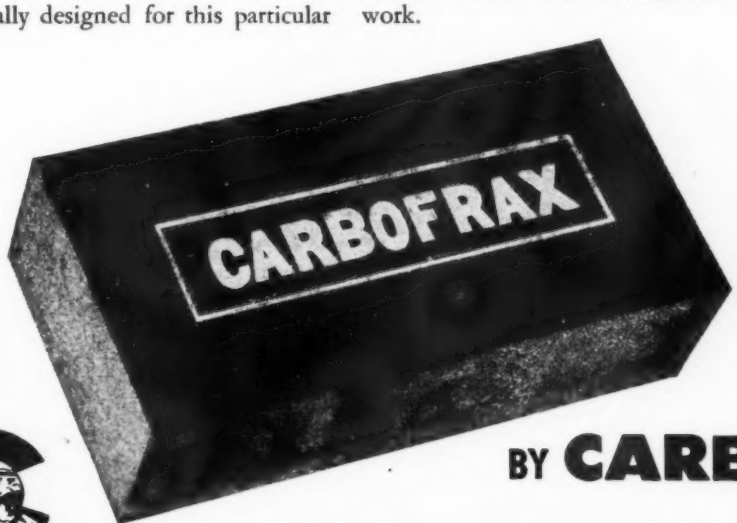
Specifically designed for this particular installation, as shown, the height of the CARBOFRAX lining may be varied to meet conditions encountered.

Increased capacity results because the entire grate area is in use at all times. Clinkers that restrict the fuel bed can not gain a toe hold in the hard dense surface of the CARBOFRAX brick work.

Fuel burns more efficiently. The furnace is on the job longer without repairs. Reports of 8 to 10 years service from a CARBOFRAX lining are not uncommon. Outages because of lining trouble are negligible. This means not only greater output through continuous uninterrupted service, but also much lower cost figures on repairs and maintenance.

A further reduction in maintenance expense often comes from the longer life of the upper walls. They are well supported at all times by the CARBOFRAX brick which do not cut or burn back.

CARBOFRAX brick provide a proved, practical means of raising the capacity and efficiency of most boiler furnaces. You can get complete engineering data promptly by writing Dept. G-96, The Carborundum Company, Refractories Division, Perth Amboy, New Jersey.

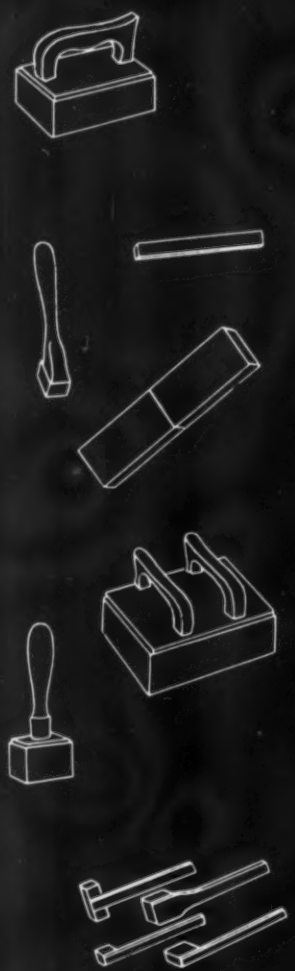


BY CARBORUNDUM
TRADE MARK

"Carborundum" and "Carbofrax" are registered trademarks which indicate manufacture by The Carborundum Company

KEEP MOTORS IN CONDITION TO RUN AT RATED CAPACITY

with IDEAL Resurfacers



It is easy to restore and maintain the rated capacity of your motors and generators with **IDEAL** Commutator Resurfacers—stop sparking, eliminate pits, burns and rough spots.

Quick! No dismantling, no reassembling. Job may be done outside of work hours. No production delays.

Easy! Resurfacers are applied by hand and smooth commutator or slip ring while the motor turns under its own power. One man does the job.

Better! Resurfacing is done while armature is running in its own bearings, thus compensating for any eccentricities. The surface is ***actually smoother*** than a lathe-turned job.

No Delay! The **IDEAL** way is the "Do It Now" way No dismounting, no moving, no shop work.

SIZES AND GRADES FOR ALL CONDITIONS—PROMPT DELIVERY

Other **IDEAL** Motor Maintenance Equipment: Precision Grinders, Mica Undercutters, Carbon Brush Seaters, Commutator Cleaning Stone, Commutator Saws and Milling Cutters, Slotting Files, Hand-Type Slotter and Scraper

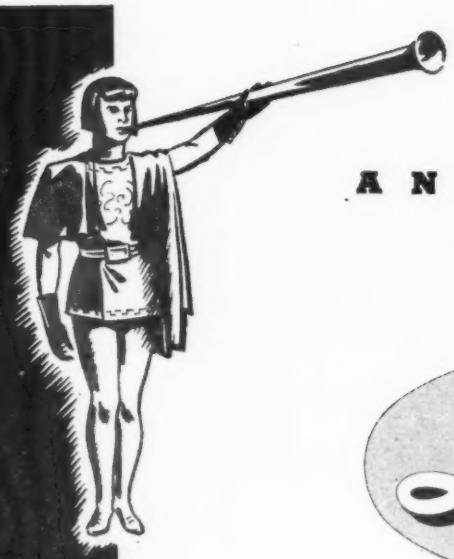
Distributed Through AMERICA'S LEADING WHOLESALERS

IDEAL INDUSTRIES, Inc.

(Successor to Ideal Commutator Dresser Co.)

1025 PARK AVENUE **SYCAMORE, ILLINOIS**

1933



Processes

FOR WATER CONDITIONING

Removal of

Hardness, Turbidity, Color, Odor, Taste, Iron, Silica, Oil, Total Dissolved Salts, Oxygen, Other Gases

FOR OTHER LIQUIDS

Removal of

Undesired Impurities from Syrups, Juices and Chemical Solutions

Recovery of

Valuable Substances from Solution or Suspension

Products

Chemical Products and Mechanical Equipment for Water Conditioning for Household, Industrial and Municipal Use; also for Conditioning of Other Liquids:

Cation and Anion Exchangers
Zeolite Water Softeners
Ion Exchange Equipment
Demineralizing Equipment
Filtration Equipment
Diatomite Filters
Chemical Feeds
Sludge Blanket Units
Cold Lime-Soda Softeners
Hot Process Softeners
Continuous Blowoff Systems
Deaerating Heaters
Vacuum Deaerators

ANNOUNCING

Liquon

A NEW NAME IN

LIQUID CONDITIONING

BACKED BY A QUARTER CENTURY OF EXPERIENCE

If you need soft water . . . clear water . . . pure water . . . or purification of other liquids . . . this announcement is important to YOU.

LIQUID CONDITIONING CORPORATION is a new organization, operated by pioneering experts in liquid conditioning with more than a quarter century of experience in this field.

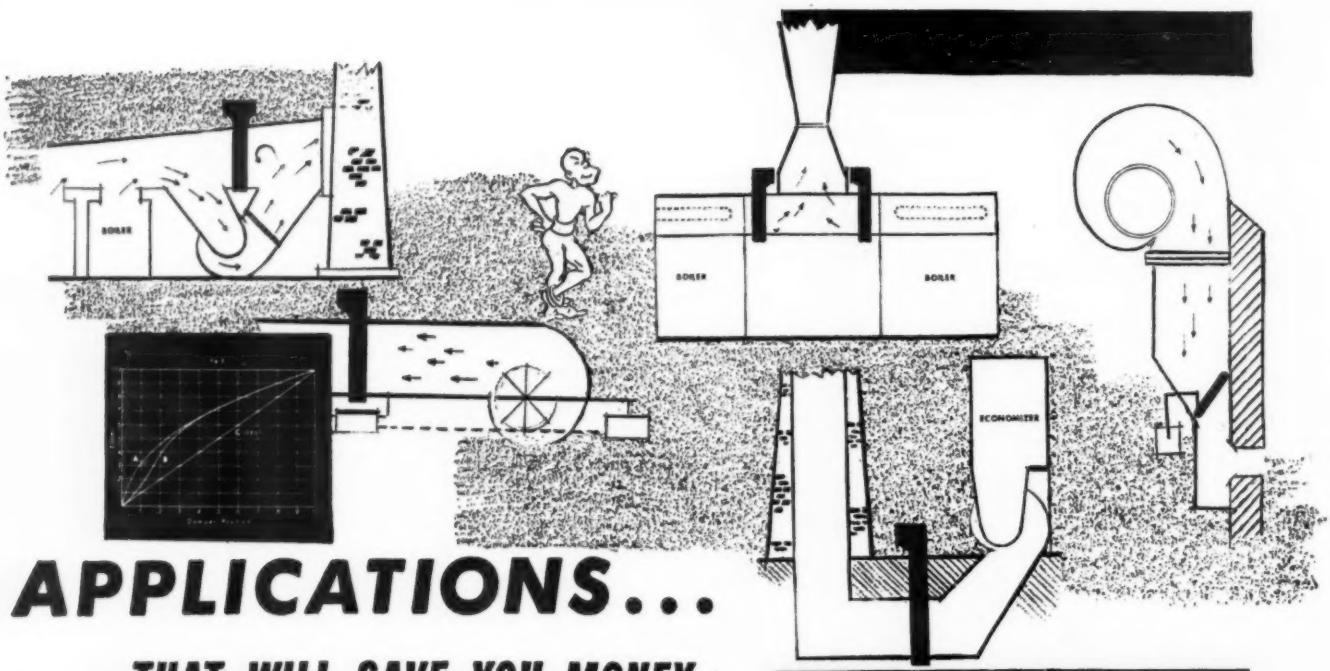
- The newness of the LIQUON organization means freedom from hide-bound procedure in the approach to and handling of your liquid-conditioning problems.
- The long experience of LIQUON engineers and chemists means full assurance that your problems will be correctly solved. Many modern methods which are now accepted as standard in the art were pioneered by members of this organization.
- LIQUON services are COMPLETE. They include every process . . . apparatus . . . material . . . for any requirement of liquid conditioning.
- Therefore, LIQUON recommendations are authoritative and impartial. Each LIQUON installation is custom-tailored for best results with your precise conditions. And each carries our overall guarantee of performance.

These are the reasons why this announcement is of significance to you . . . why you should consult LIQUID CONDITIONING CORPORATION on your problems concerning water and other liquids.

Write us today. Your inquiry will not involve the slightest obligation to you, and may result in important benefits and savings in your plant.

LIQUID CONDITIONING CORPORATION
423 West 126th Street, New York 27, N. Y.

LC-100



APPLICATIONS...

...THAT WILL SAVE YOU MONEY AND GIVE MORE EFFICIENT OPERATION

IN the power field, Heacon Dampers have been installed as uptake dampers, bypass dampers, isolation dampers and in many other applications.

Above are shown sketches of a few of these. Each is an actual problem solved. Each resulted in operational savings and greatly increased efficiency. In many cases, outage time for maintenance was cut from thirty to fifty percent.

Regardless of the damper application, if tightness and control are necessary factors, Heacon Dampers are the *only* solution.

The Heacon Catalog No. 10 will give details of this outstanding new damper. Write for it.

THERMIX ENGINEERING COMPANY
Project and Sales Engineers
FIRST NATIONAL BANK BLDG., GREENWICH, CONN.

HEACON GIVES CONTROLLED FLOW

1. MORE RELIABLE OPERATION
2. INCREASED CAPACITY
3. REDUCED MAINTENANCE
4. GREATER FLEXIBILITY
5. HIGHER EFFICIENCY
6. BETTER REGULATION
7. LOWER BANKING LOSSES
8. QUICKER STARTING
9. SAFER OPERATION
10. CLEARANCE WITHOUT LEAKAGE

HEACON INC DAMPERS

FIELD PROJECT ENGINEERS:

ATLANTA, GA.
C. E. Johnson & Associate
Bona Allen Bldg.

BOSTON, MASS.
Ames & Holbrook
89 Broad St.

BUFFALO, N. Y.
Brookman-Hazel Associates
250 Delaware Ave.

CHARLOTTE, N. C.
T. C. Heyward
1408 Independence Bldg.

CHATTANOOGA, TENN.
Edgar A. Rogers
Chattanooga Bank Bldg.

CHICAGO, ILL.
Engineering Sales Co.
1307 S. Michigan Ave.

CINCINNATI, O.
F. Eliman
Chamber of Com. Bldg.

CLEVELAND, O.
H. W. Kaiser Co.
1836 Euclid Ave.

DETROIT, MICH.
Metrol Co.
5538 Cass Ave.

DULUTH, MINN.
A. H. Kennedy
214 First National Bldg.

HOUSTON, TEXAS
J. A. Rossiter Co.
P. O. Box 1095

KANSAS CITY, MO.
F. W. Hay & Co.
2734 Cherry St.

LOS ANGELES, CALIF.
A. W. Anderson
164 S. Central Ave.

MINNEAPOLIS, MINN.
Hoyt A. Sevey
314 South 9th St.

NEW HAVEN, CONN.
Daniel Smerling
P. O. Box 1169

NEW ORLEANS, LA.
Arthur C. Hays
1221-23 Carondelet Bldg

NEW YORK, N. Y.
Parry Engineering Co.
154 Nassau St.

PHILADELPHIA, PA.
Thermix Engineering Co
Room 1031
Broad Street Station Bldg

PITTSBURGH, PA.
Herr-Harris Co.
545 William Penn Way

RICHMOND, VA.
Frank Howell Co.
Room 412, American Bldg.

ROCHESTER, N. Y.
Johnston Engineering Co.
31 Gibbs St.

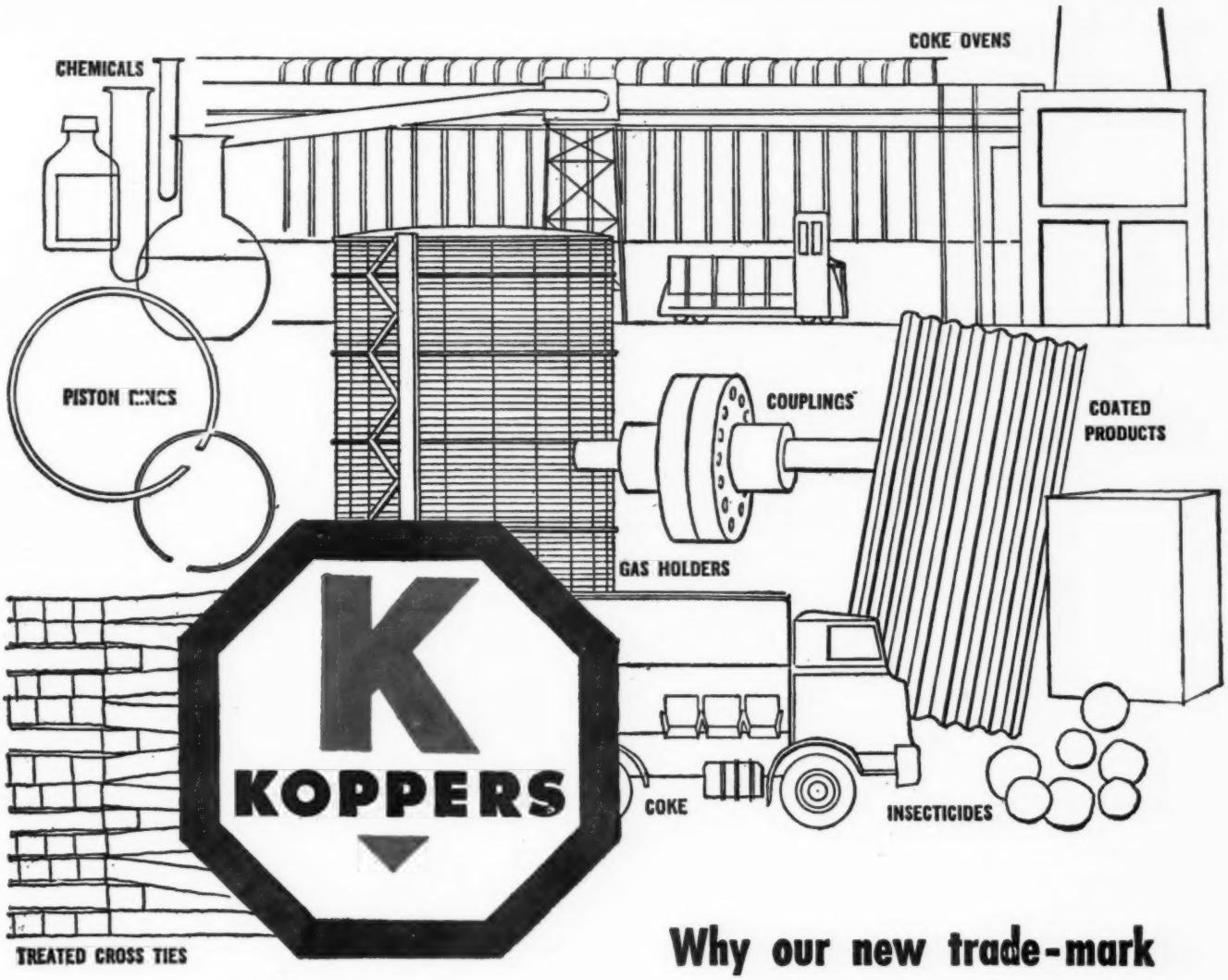
SALT LAKE CITY, UTAH
The Lang Co.
267 W. First South

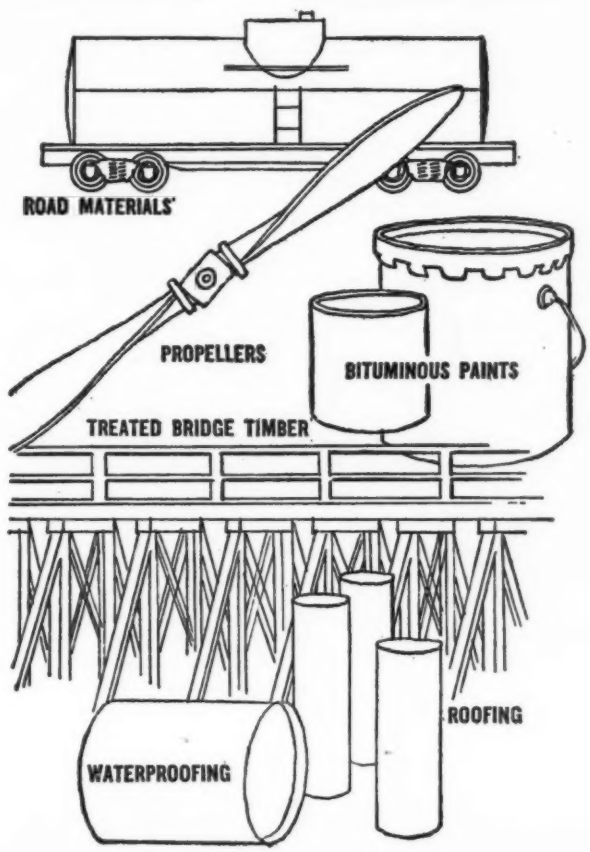
SAN FRANCISCO, CALIF.
S. Herbert Lanyon
58 Sutter St.

SCHENECTADY, N. Y.
Mr. D. R. Whipple
1550 State St.

SEATTLE, WASH.
Lewis, Watts & Freeman, Inc.
Room 520, 905 Second Ave. Bldg.

WASHINGTON, D. C.
T. W. McGuire Co.
Bond Bldg.





Why our new trade-mark is important to you

Every day, you place your health, your safety, your children, even your life at the mercy of manufacturers whose products you trust.

Often you do it because of some small mark which doesn't actually say anything in words, but which says volumes in the meanings you read into it.

That's what trade-marks mean to the American people. In effect, the trade-mark says, "Here is a manufacturer who is so sure of this product that he puts his name on it."

That's why our new Koppers trade-mark is important to you.

There are dozens of Koppers products; there will be dozens more as opportunities expand in the rapidly growing chemical field.

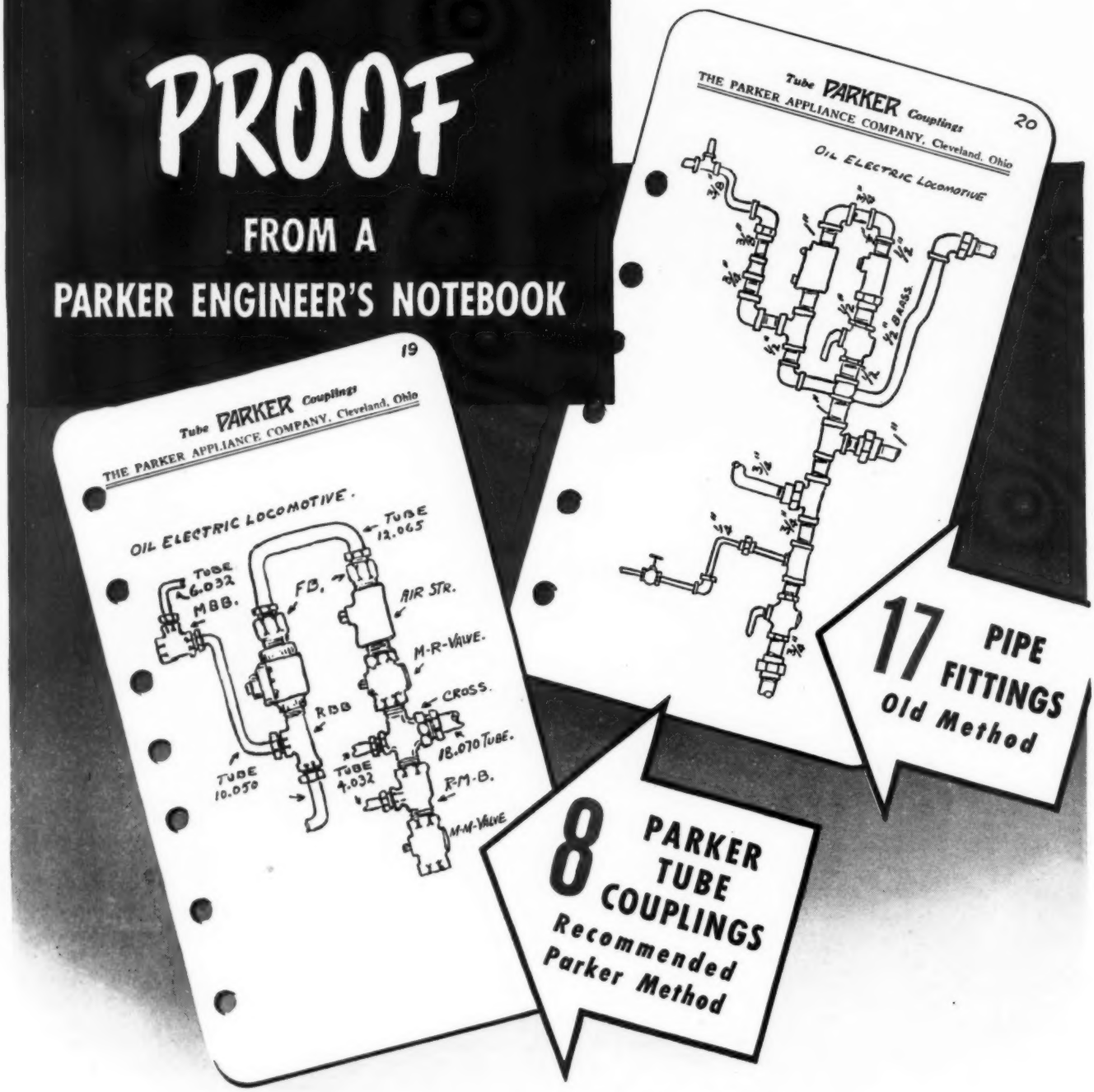
Often you will not be able to see the Koppers label on those products—you can't see it, for example, on road paving material or on a bottle of medicine—but the roadbuilder sees it and the medicine maker sees it, and their confidence in it is your safeguard.

Koppers also is well known as a dependable source for many other products and services which we furnish directly, such as the design and construction of coke ovens, roofing material, piston rings, couplings, propellers for your private plane, coke for your furnace, moth balls for your clothes, paints, pressure-treated wood and scores of others.—Koppers Company, Inc., Koppers Building, Pittsburgh 19, Pa.

KOPPERS—THE INDUSTRY THAT SERVES ALL INDUSTRY

PROOF

FROM A PARKER ENGINEER'S NOTEBOOK



Better than a two-to-one advantage from the standpoint of number of connections, alone!

But that's only *one* advantage of Parker Fluid Power Engineering. Take the actual case pictured: the circuit is more compact, more efficient, cleaner (because there are no sealing compounds or pipe threading operations), and it's vibration-proof, too.

Every Parker fitting is a *coupling*—easy to disassemble without disturbing the circuit or using gaskets and compounds. You'll save time, money and materials at every stage.

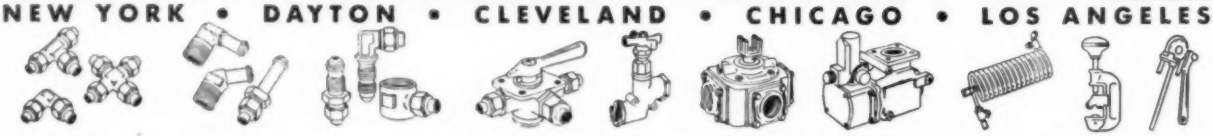
May we show you how Fluid Power can be engineered to your requirements?

* * *

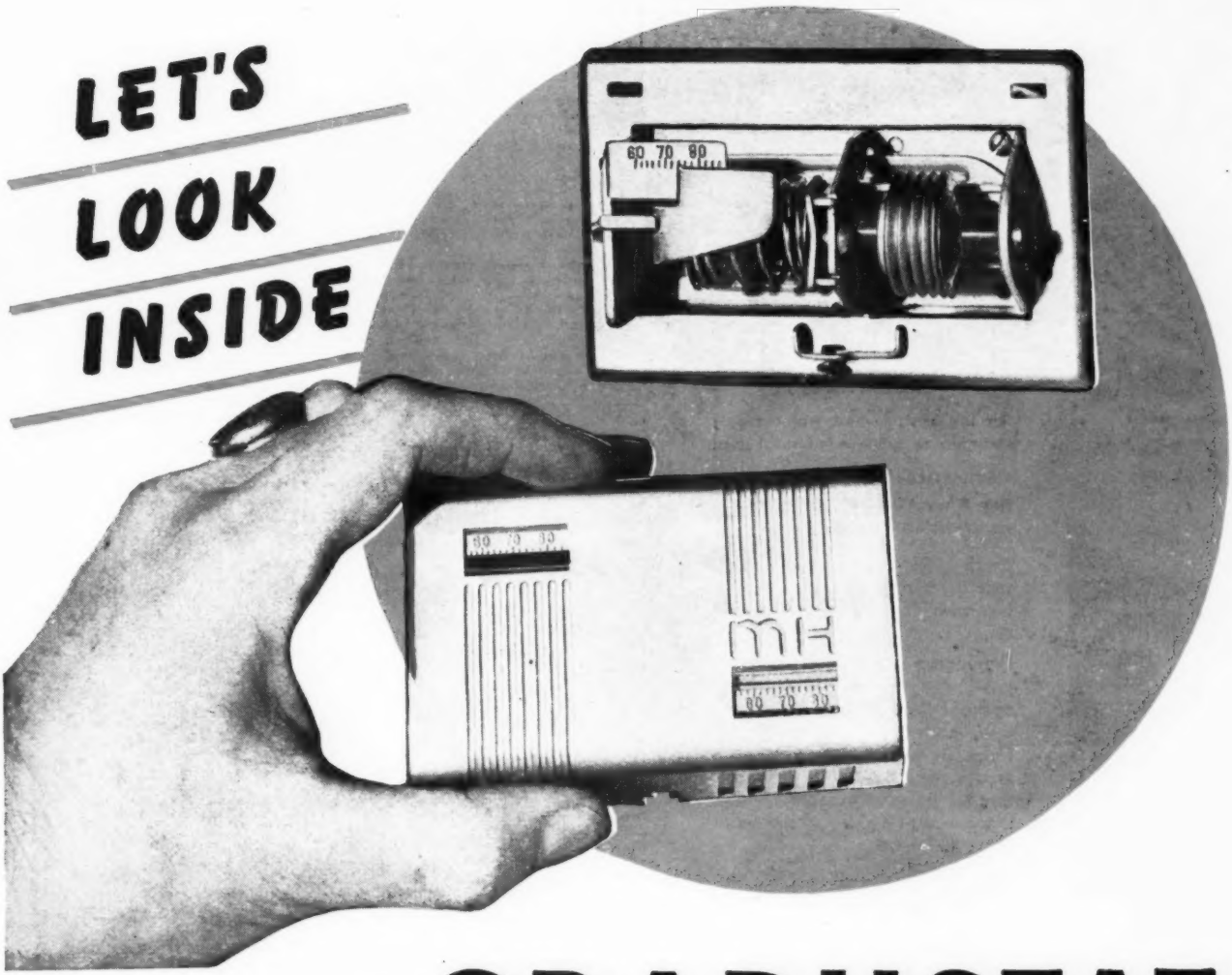
Standard Parker valves and couplings are built in sizes to cover a wide range of exacting conditions—stocks are available at your distributors and at Parker warehouses.

THE PARKER APPLIANCE CO.

NEW YORK • DAYTON • CLEVELAND • CHICAGO • LOS ANGELES



FLUID POWER PRODUCTS FOR ALL INDUSTRY



THE GRADUSTAT!

IT'S the engineering design of the Honeywell Gradustat that has established the leadership of this pneumatic thermostat — leadership demonstrated by performance in industrial plants everywhere.

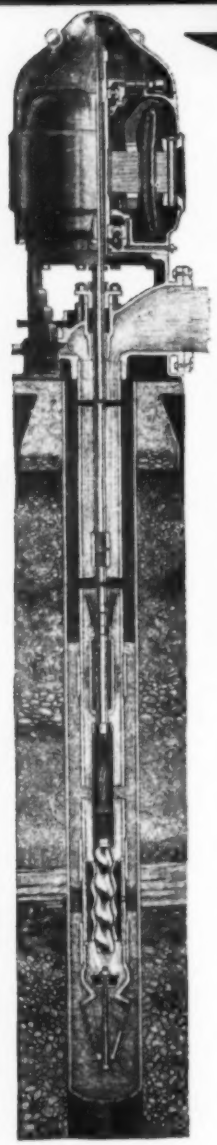
And there is good reason for this superior performance. For example, the temperature sensitive element of the Gradustat is mounted so that there is no other mechanism above or below it, thus permitting free passage of air across the element. The result—sensitivity and accuracy of control far greater than afforded by conventionally mounted pneumatic thermostats.

The Gradustat is a non-bleed thermostat that employs a pressure reducing principle which does not rely on constant bleeding of air. Except when the valve or motor is moving in one direction, the system is tight, no air is wasted. This means a smaller compressor and lower operating cost. An adjustable throttling range or differential permits the Gradustat to provide uniform control without hunting or wide variations in temperature. Remember, every one of these Gradustat features means definite benefits through efficient, dependable heat control . . . Minneapolis-Honeywell Regulator Company, 2607 Fourth Avenue South, Minneapolis 8, Minnesota.

MINNEAPOLIS
Honeywell
CONTROL SYSTEMS

IT'S THE PRODUCT BEHIND THE NAME THAT COUNTS

HERE'S HOW:
"Squeezing Water Upward"
SQUEEZES UPKEEP DOWN



PEERLESS
HI-LIFT PUMPS
(Reg. U. S. Pat. Off.)

For low-cost, limited water supply demands of multiple industrial uses.

CAPACITIES: 600 to 3300 Gals. per Hour FOR WELLS AS SMALL AS 4" INSIDE DIAMETER.

Peerless HI-LIFT is the pump that gives magic wings to water lift, with an ingenious pumping element.

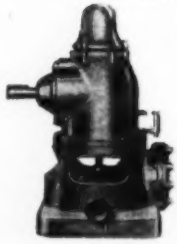
Employing simplicity to the best possible advantage, Peerless has replaced high shaft speed, vibration, and high operating cost, found in most conventional type pumps, with a slow, smooth continuous positive pumping action that literally "squeezes" the water upward.

The only moving part in the pumping element consists of a hard, heat-treated, chrome-plated stainless steel rotor, helically contoured and revolving within a similarly shaped cutless rubber stator. Both of these units are highly resistant to abrasive action.

Buy the pump that "squeezes" water upward and squeezes upkeep down. Investigate today the many possibilities offered you with a Peerless Hi-Lift Pump.

PEERLESS TURBINE PUMPS

Gearturbo (Right Angle Gear Drive) Illustrated



Capacities up to 30,000 g.p.m.

Oil or Water lubrication.

Hydro-Foil (Propeller Type) Pumps.

Capacities up to 220,000 g.p.m.

SELF-PRIMING
NO OIL USED UNDERGROUND

PATENTS: Manufactured under R. Moineau patents, U.S. 1892217, 2028407 and Re-issue 21374. Canadian Patent 352574. By Exclusive License to Robbins and Myers, Inc. Peerless U.S. Patents 2208937, 2338937 & 2346426. Other Patents pending.

PEERLESS PUMP

PEERLESS PUMP DIVISION
FOOD MACHINERY CORPORATION
Canton 6, Ohio • Quincy, Illinois • Los Angeles 31, California
DISTRIBUTORS IN ALL PRINCIPAL CITIES

Are you equipped to hold your job?—to get a new one?

The men who are keeping their jobs today—who are not feeling the whip of competition—are those who have kept one jump ahead of their jobs. They are the men who are equipped with a thorough-going and growing knowledge of the business they are in.

It works in the power plant field as well as in any other. Some men fit themselves to do a little more than their job calls for. They fit themselves to do a little more than the other fellow. They make a steady effort to equip themselves with the best kind of job insurance there is—KNOWLEDGE.

How about you? Do you know how quickly knowledge will pile up—how quickly you will become more valuable—if you spend a few minutes a day, regularly studying sound books like the McGraw-Hill Library of Power Plant Practice? Do you know how easily it can be managed, paying only a few cents a day, while you use the books?

Thousands of men have followed this plan to win advancement or to make their jobs safe. You can too. Read about this Library and our Free Examination Offer. Then send the attached coupon to us today

POWER PLANT PRACTICE

(6 volumes—2,477 pages, 2,404 illustrations)

The Library of Power Plant Practice is the standard of the power plant field. It is accurate — it is thorough — it is complete. It is the result of years of experience with power plant problems. The man who has it has the best. The Library covers the whole field—nothing is omitted. The solution of every problem is plainly worded or explained with a clear illustration. The little stickers and the big troublesome problems are all worked out in advance for you. There can be only one result from studying these books a few minutes each day — more money in your pocket.

No books dealing with the work of the power plant man were ever so complete — so authoritative — so practical in text and illustrations as these. The man who put this set of books into his library can do so knowing that he has the utmost in power plant books—a set that will give him in language he can understand, all the information he needs in order to get ahead in his work.

Easy to Understand

These books are written in everyday easy-to-understand language. They are written to help the man on the job. It is just as if the author were working in the plant by your side and giving you the benefit of his vast knowledge, man to man. There is no bunkum in this Library, nor is it cluttered up with impractical theories. It is a Power Plant Library FOR POWER PLANT MEN.

Glance at the titles of the books in the photograph. They will give you an idea of how completely this Library covers Power Plant Practice. Here you have all the information necessary to make you indispensable on the job.

See it 10 days—Send no money

Fill in and mail the coupon below and we will send you the six volumes of the Power Plant Library for 10 days' examination. If you decide to keep the books after examining them, just send $3.50 and then $3.00 a month until the total low price of $18.50 has been paid. See the coupon below for details. Send it Now and HOLD THAT JOB!

McGRAW-HILL ON-APPROVAL COUPON

McGRAW-HILL BOOK CO., INC., 330 West 42nd St., N. Y. C. 18

Ship to me charges prepaid the six volumes of the Library of Power Plant Practice. If satisfactory, I will send $3.50 in ten days and $3.00 a month until the price of $18.50 has been paid. If not wanted I will return the set to you postpaid. (To insure prompt shipment write plainly and fill in all lines.)

Name .....

Home Address .....

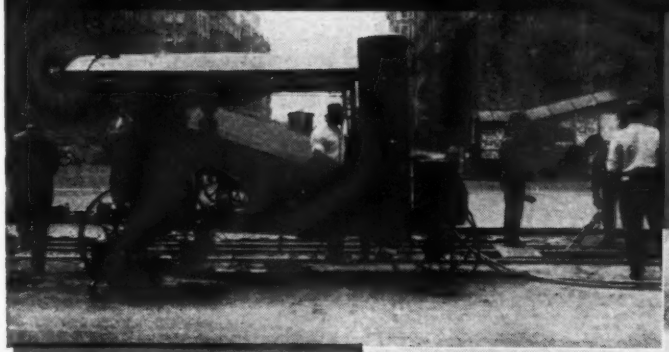
City and State .....

Company .....

Position ..... P. 9-46

For Canadian price, write Embassy Book Co., 12 Richmond St. E., Toronto 1

Thermoid — For Progress in Industry



← Early air compressor, driven by electric motor, delivering 125 cubic feet of air per minute through Thermoid hose for street railway construction.

➡ To get an airport built, fast, a battery of giant Ingersoll-Rand compressors each delivers 500 cubic feet of air per minute through Thermoid Molded Air Hose No. 210. Note how small the mechanic seems beside this equipment.

Today's Thermoid Air Hose is tough. It stands up to flexing, pulsation-frequencies, pressures, hard knocks and abrasion that would quickly destroy the best air hose of a few years ago.

Thermoid's improvements in air hose should interest you, for they are typical of the way we contribute to industrial progress. Through the years Thermoid has matched the ingenuity of engineers and inventors. Making available constantly improved industrial rubber products, we have helped them translate their ideas and blue-prints into equipment able to perform faster and more efficiently.

Consult your Thermoid Representative about your problems. Like so many, you may find, "It's Good Business to Do Business with Thermoid."

Send for our latest Air and Welding Hose Folder #3728—just off the press!

THE THERMOID LINE INCLUDES: Transmission Belting • V-Belts and Drives • Conveyor Belting • Elevator Belting • Wrapped and Molded Hose • Sheet Packings • Industrial Brake Linings and Friction Products.

Thermoid Rubber

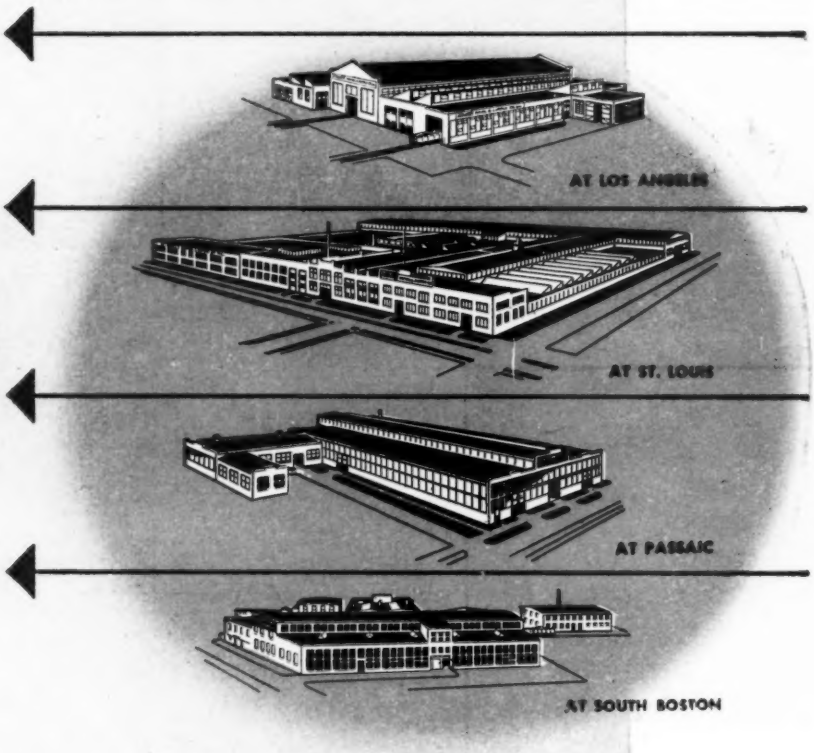
DIVISION OF THERMOID COMPANY

308 Whitehead Road, Trenton 6, New Jersey

Contributor to Industrial Advancement Since 1880

TO THE USER OF FABRICATED PIPING

4 PLANTS *Are Better* THAN 1



There are four Midwest pipe fabricating plants located in different parts of the country, because Midwest has found that "four plants are better than one" for the user of piping.

In addition to shortening shipping distances and making for a better understanding of the customers' individual problems, four plants provide other important benefits in which all Midwest Piping users participate.

Extra reserve capacity is provided for the emergency job. If extreme speed is sufficiently important, a job can be divided among two or more plants. An overload in one plant often can be handled by temporarily transferring skilled workers from other plants.

One of the greatest advantages is the continuous exchange of information and experience between staff members of the four plants. New techniques developed in one plant are made known to all. Piping problems which may be new to one plant probably are very familiar to another where the "know how" information is available at once. Friendly rivalry—constant study of piping problems by four organizations—tends to advance the art of piping fabrication much more rapidly than would otherwise occur.

All of this works to the advantage of piping users —four plants are better than one.

Midwest can give you better piping and better service . . . whether you need only a simple bend or the most elaborate piping job completely erected and ready for operation.

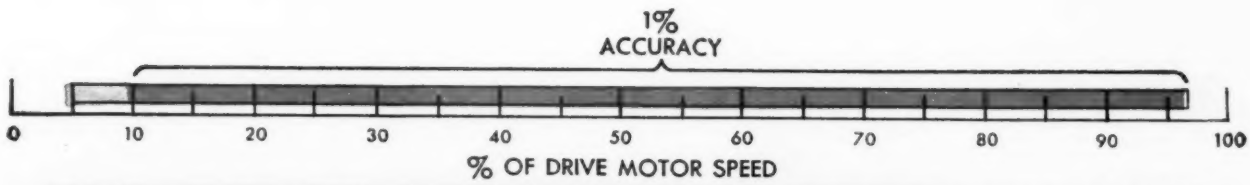
1527

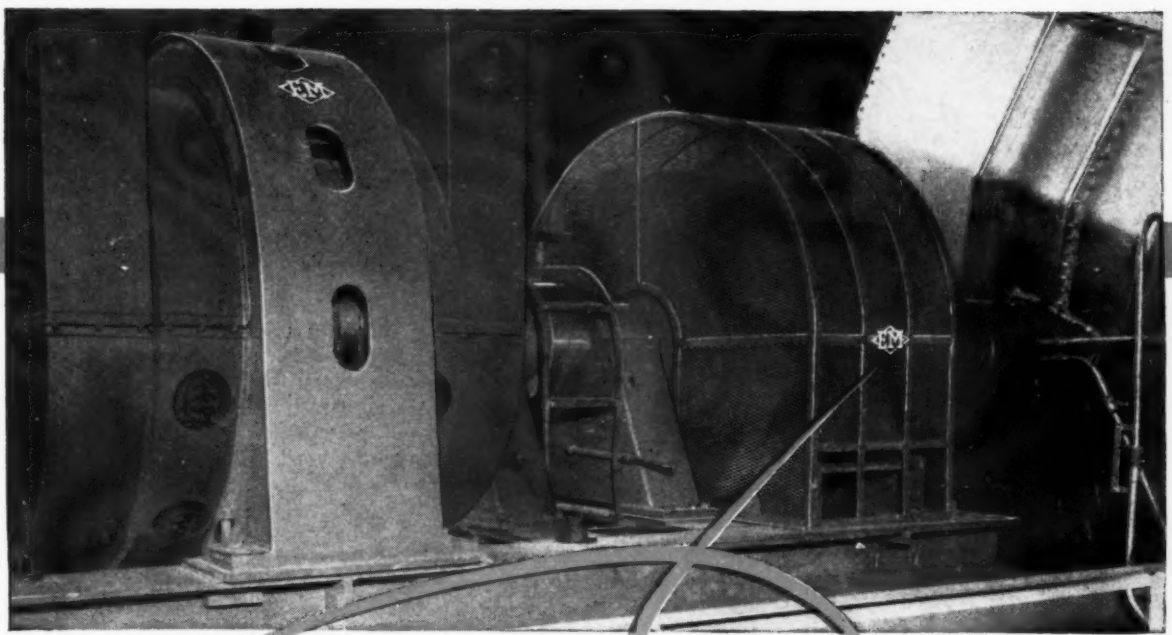
MIDWEST **PIPING AND SUPPLY COMPANY, Inc.**

Main Office: 1450 South Second Street, St. Louis 4, Mo.
Plants: St. Louis, Passaic (N. J.) and Los Angeles
Subsidiary: Lumsden & Van Stone Co., South Boston 27, Mass.
Sales Offices: New York 7—30 Church St. Chicago 3—645 Marquette Bldg.
Los Angeles 33—520 Anderson St. Houston 2—229 Shell Bldg.
Tulsa 3—533 Mayo Bldg. Atlanta 3—Red Rock Bldg. South Boston 27—426 First St.

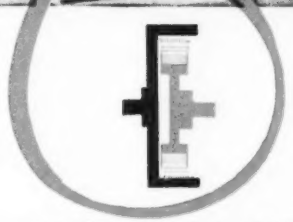
PIPING FABRICATORS AND CONTRACTORS

PRECISE *wide-range speed control*





ADJUSTABLE SPEED *Magnetic* DRIVE



● Two simple basic parts—a ring and a magnet—transmit torque electromagnetically within a clean, compact and self-contained unit.

● Effective regulation of boiler draft fan output requires a drive with adjustable speed and wide-range control.

The E-M Magnetic Drive answers this need accurately in the 10% to 97% range of drive motor speed. Speed-sensitive, rather than torque-sensitive, Magnetic Drive with the Regutron electronic control automatically maintains speed within 1% regardless of changing torque requirements or variations in voltage. At 5% to 10% speed, control persists with sufficient accuracy for banked fire operation.

Swinging steam loads demand responsive auxiliaries. With Magnetic Drive, increased drive effort is available within the fraction of a second required for build-up of the magnetic field. Torque available for fan acceleration is more than double normal full-load torque.

Because the fan never runs faster than necessary for required output, "boiler house roar" is eliminated, erosion minimized...fans last longer.

The E-M Synchronous Motor-Magnetic Drive set shown above operates an induced draft fan at Columbus & Southern Ohio Electric Company's Picway Station, Columbus, Ohio. Rated 640 hp, 680/180 rpm, its utility increases with controllable motor power factor.

See your nearby E-M field engineer for information or write for copy of Publication 183, "The E-M Adjustable Speed Magnetic Drive"

Electric Machinery Manufacturing Co.
MINNEAPOLIS 13, MINNESOTA

MANUFACTURERS
OF MAGNETIC DRIVES FOR
BOILER DRAFT FANS

A-2039

E-M

MAGNETIC DRIVES
FOR CENTRIFUGAL PUMPS,
COMPRESSORS, BLOWERS

The Genuine for accessibility

Squires

Removal of two bolts frees the top cap—and the valve and seat are completely exposed to view.

The accessible Squires has become a byword among power plant operators.

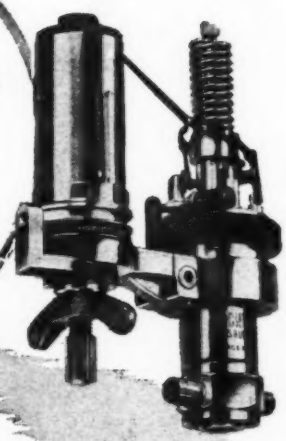
Reliability and economy are among its popular points and besides Squires Traps positively will not wire draw.

The
C. E. Squires Co.
E 40th St. and Kelly Ave.
Cleveland 3, Ohio

Squires
TRADE MARK
Reg. U. S. Pat. Office

May we send you Catalog A-9

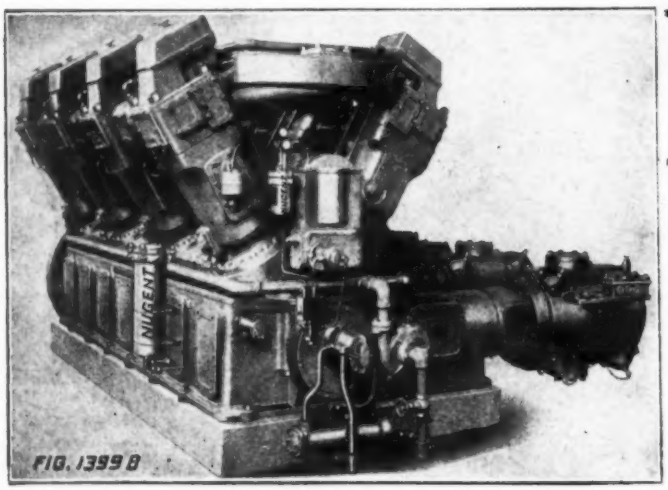
The
"STANDARD" CARD-DRAWING INDICATOR
for
Protective Engine Maintenance



You can help maintain original engine efficiency, assure uninterrupted power and maximum fuel economy by making regular indicator check-ups with the Type 2-CP Indicator illustrated. It is the recognized "standard" card-drawing indicator for medium and moderately high speed Diesels, and is also in widespread use on steam engines, gas engines, compressors, and pumps.

Write for Bulletin 293, which gives full particulars.

Made by
Bacharach
INDUSTRIAL INSTRUMENT CO.
7000 BENNETT ST., PITTSBURGH 8, PA.
World's Largest Manufacturer of Engine Indicating Equipment



(Above): Ingersoll-Rand 8-cylinder 10½" x 12½" Diesel-driven air compressor unit, equipped with Nugent Filters for lube oil and Diesel fuel. (Right): Close-up of the type of Nugent lube oil filter used on the above unit.

Compressor Efficiency INCREASED with NUGENT FILTERS

Helping Ingersoll-Rand protect its famed reputation for compressor efficiency, low maintenance and long life are Nugent Filters, used to filter lube oil for compressor units, as well as fuel and lube oil on Diesel power units. By depending on the proved design and dirt removing ability of Nugent Filters, I-R compressor crankcases can remain sealed, completely protected against damage from foreign particles. Diesel engines used for powering these compressors are doubly protected by Nugent Filters, as both fuel and lube oil are kept practically 100% clean all the time. Let Nugent engineers help solve your filtration problems.

NUGENT
TRADE MARK

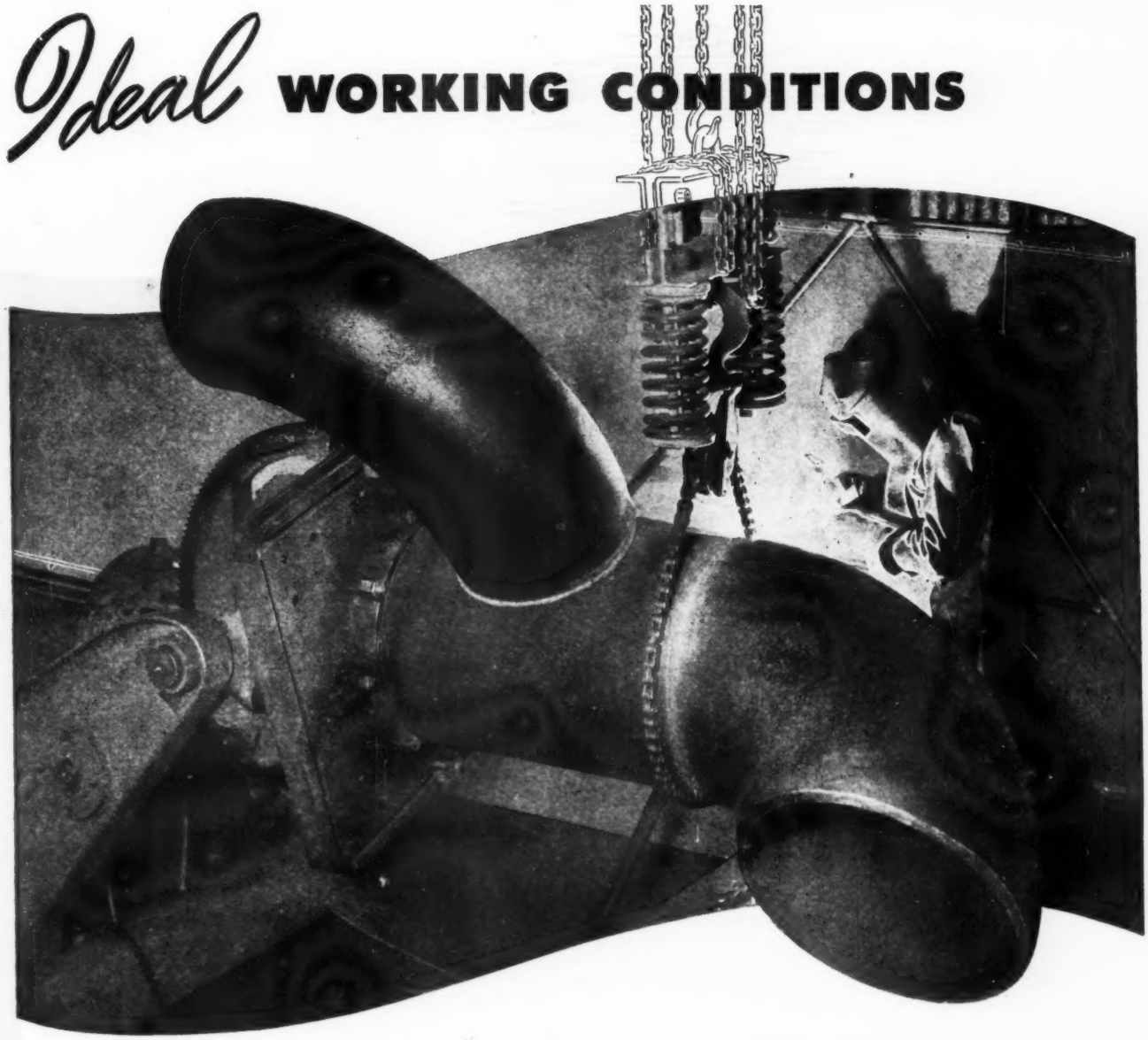
Nugent Filters

ESTABLISHED 1897

WM. W. NUGENT & CO., INC.
402 N. Hermitage Ave. Chicago 22, Illinois

Fuel Oil Filters
Lube Oil Filters
Lubricating Systems
Sight Flow Indicators
Oiling Devices

Ideal WORKING CONDITIONS



. . . *Another Reason for the Superiority of Modern* SHOP FABRICATION

DIFFICULT fabrication that cannot be done efficiently in the field is handled easily in the completely equipped Pittsburgh Piping plant. For example, shop equipment such as that illustrated, enables the welder to work in a down-hand position on circumferential welds. Each weld is inspected, and laboratory facilities are utilized as required to analyze welding specimens.

Quality—the important factor in the safe performance of any installation—is assured when piping is pre-fabricated in the shops of Pittsburgh Piping and Equipment Company.

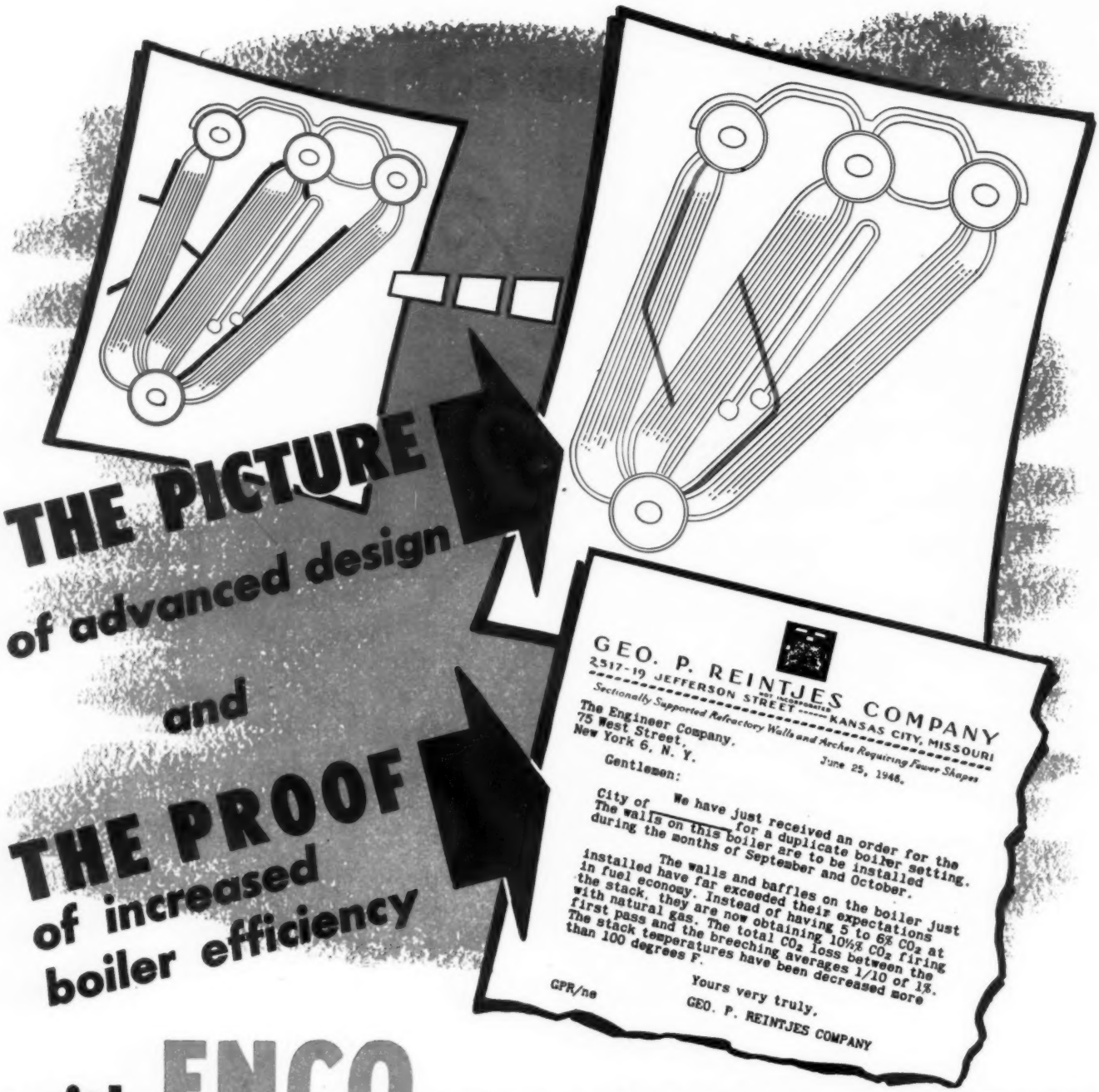
The advantages of shop fabrication—extended experience, specialized engineering help, every facility for bending, Van Stoning, machining, heat-treating, stress-relieving, pressure-testing—assure an infinitely better piping job.

Pittsburgh Piping

AND EQUIPMENT COMPANY

10 Forty-Third Street—Pittsburgh, Penna.

Woolworth Building, New York
Chamber of Commerce Bldg., Indianapolis
Book Tower, Detroit
525 Market Street, San Francisco
634 S. Gramercy Place, Los Angeles
Peoples Gas Building, Chicago
Public Square Building, Cleveland
10 High Street, Boston
Heights State Bank Bldg., Houston
Whitehead Building, Atlanta



THE PICTURE of advanced design

and

THE PROOF of increased boiler efficiency

GEO. P. REINTJES COMPANY
2317-19 JEFFERSON STREET — KANSAS CITY, MISSOURI
Sectionally Supported Refractory Walls and Arches Requiring Fewer Shapes

The Engineer Company,
75 West Street,
New York 6, N. Y.

June 25, 1946.

Gentlemen:

City of _____ We have just received an order for the _____ for a duplicate boiler setting. The walls on this boiler are to be installed during the months of September and October.

The walls and baffles on the boiler just installed have far exceeded their expectations in fuel economy. Instead of having 5 to 6% CO_2 at the stack, they are now obtaining 10½% CO_2 firing with natural gas. The total CO_2 loss between the first pass and the breeching averages 1/10 of 1%. The stack temperatures have been decreased more than 100 degrees F.

Yours very truly,
GEO. P. REINTJES COMPANY

GPR/ne

with ENCO STREAMLINED BAFFLES

Study these diagrams for just a moment. Notice how the improved baffle design assures a uniform, high velocity gas flow over every square foot of heating surface. Enco Streamlined Baffles are smoothly curved to maintain a cross-flow of gases across the tube banks. Dead gas areas, bottlenecks and soot pockets are eliminated. The result: reduced draft losses and maintenance costs—increased operating efficiency.

Enco Streamlined Baffles are engineered to the exact requirements of your boiler and installed by experienced Enco-trained crews. The 18 page Enco Bulletin, BW-44, fully describes the profit-proved advantages of Enco Streamlined Baffles and their adaptability to every type of Water-tube Boiler. Call or write for your free copy today!

The Engineer Company produces:

- Enco Streamline Baffles
- Enco Oil Burners
- Enco Fuel Oil Pumping and Heating Units
- Enco Automatic Oil-Electric Ignition System
- Enco Automatic Combustion Control

THE ENGINEER COMPANY

75 West Street
New York 6, New York

Canadian Representative:
F. J. Raskin, Ltd., 370 Rachel E., Montreal, P. Q.

EC-465

TO PROTECT CIRCUIT OPERATION, REDUCE BREAKDOWNS, CUT MAINTENANCE

A few of the 125 Rockbestos constructions.

Rockbestos A.V.C. Power Cable

Rockbestos A.V.C. Boiler Room Wire

Rockbestos A.V.C. Switchboard Wire

. . . wire with ROCKBESTOS A.V.C.

Wherever heat shortens wire life . . . in factories, mills and generating plants . . . Rockbestos A.V.C. reduces costly power, control and lighting circuit maintenance by eliminating wire failures.

Insulated with heat and flame resistant impregnated asbestos these *permanently insulated* wires and cables permit continuous operation under high temperatures and other failure-creating conditions. They protect power supply, keep overloaded motors running and apparatus operating because they take heat and moisture without baking out, cracking or flowing . . . and resist the destructive attack of fumes, oil, grease and even flame.

When rewiring circuits or putting in new installations use Rockbestos A.V.C. wires, cables and cords in trouble-making locations. They will prevent wire-failures and equipment outage and save money in circuit maintenance.

Rockbestos A.V.C. constructions in 600 to 5000 volt ratings include single and multi-conductor power cables, switchboard and lighting wires, control cables and N.E. Code types. Write for a catalog which describes them and various Rockbestos All-Asbestos insulated wires and cables.

ROCKBESTOS PRODUCTS CORPORATION
154 Nicoll St., New Haven 4, Conn.

9 Reasons Why Rockbestos A.V.C. Prevents Wire-Failure

1. **Won't age or deteriorate**
2. **Won't bake brittle, crack or flow under heat**
3. **Won't burn or carry flame**
4. **Corrosive fumes won't rot it**
5. **Remains permanently flexible**
6. **Resists oil, grease and moisture**
7. **Withstands conductor-heating overloads**
8. **Gives greater current carrying capacity**
9. **Reduces circuit maintenance expense**

These characteristics are built into 125 Rockbestos constructions including the wires illustrated.

ROCKBESTOS A.V.C.

The Wire with Permanent Insulation

NEW YORK BUFFALO CLEVELAND CHICAGO
PITTSBURGH ST. LOUIS LOS ANGELES
SEATTLE SAN FRANCISCO PORTLAND, ORE.

INSTANTANEOUS SERVICE

MARION Gulf Stream Hot Water Heater

Utilize low pressure or live steam to assure abundant hot water. GULF STREAM heats swiftly through four concentric tubes, including outer shell, providing intimate steam and water contact.

● Steam fills central tube and annular space between two middle tubes. Water enters through pipe at extreme left, fills annular space between central tube and one surrounding it and between shell and next inner tube. Slidable packing glands at shell ends provide for expansion and contraction, prevent strains and leaks. Condensate moves to trap and returns to system, conserving all heat value. Here is ECONOMY and DEPENDABILITY.

Line ranges from 4" to 8" in diameter, 4' to 12' in length. Capacity ratings with steam at 25 lbs. are 370 to 4,335 GPH with temperature rise from 50° to 180° F. Installation requires little space. May be near floor line, ceiling or on wall. Standard design allows for 150 lbs. working pressure.

PLANS SUBMITTED FOR ANY APPLICATION.

SEE YOUR DEALER OR WRITE US

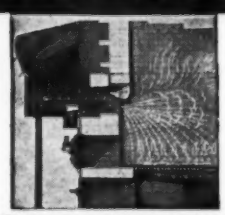
THE MARION LINE

MARION MACHINE, FOUNDRY & SUPPLY CO.
Marion, Indiana, U. S. A.

FYR-FEEDER MULTIPLE SPREADER STOKERS

Available Now!

FEATURING:



AIR JET COAL PROPULSION

• FYR-FEEDER pays for itself in coal and labor savings. • Automatic, modern, high efficiency firing at its best! • Increases boiler capacity with cheapest grades of coal — screenings or sweepings, wet or dry. CUTS FUEL BILLS! • Easy to operate. Responds instantly to sudden load changes. Burns fines in suspension; larger pieces on grate. Beautifully clean flame. • Safe. Dependable. Multiple Burners. Quality construction. • Easily installed in minimum time. Standard ratings from 100 to 12,000 lbs. of coal per hour. Wire, phone, or write.

FYR-FEEDER Multiple SPREADER STOKER
IT'S EFFICIENT
IT'S AUTOMATIC
PAYS FOR ITSELF

FYR-FEEDER INDUSTRIAL STOKERS
18-R E. Erie St., Chicago 11, Illinois

- ☐ Interested in FYR-FEEDER Dealership
- ☐ Interested as Sales Representative
- ☐ Send literature and delivery information
- ☐ Have representative call

Name_____
Company_____
Address_____

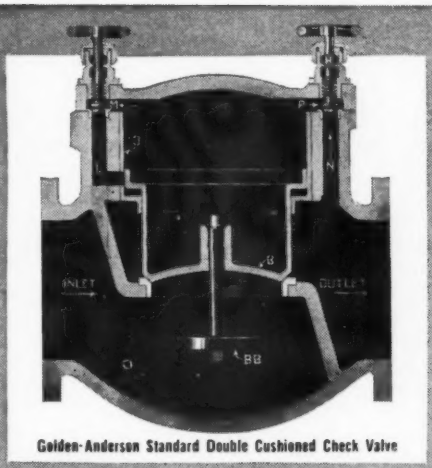
New plant

New location

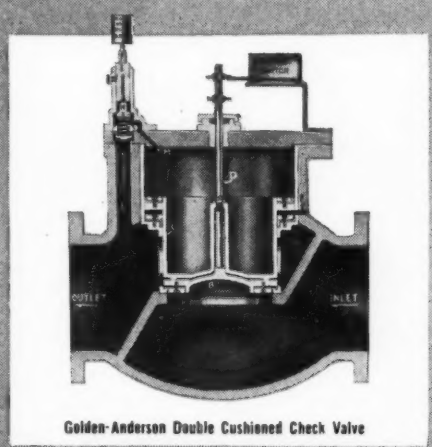
BOILER TUBE CO. OF AMERICA

McKEES ROCKS, PA.
(Pittsburgh District)

PITTSBURGH • NEW YORK • CHICAGO
FRED S. RENAULD & CO., LOS ANGELES

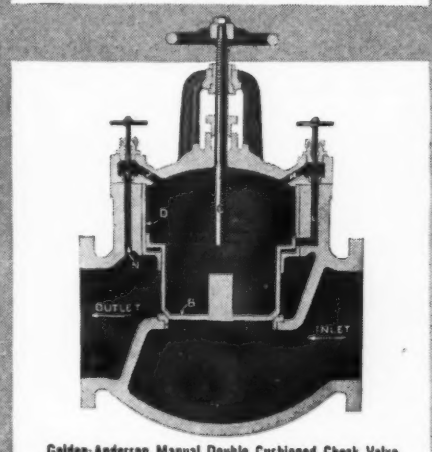


Golden-Anderson Standard Double Cushioned Check Valve



Golden-Anderson Double Cushioned Check Valve

Golden-Anderson Manual Combination Check Valve



Golden-Anderson Manual Double Cushioned Check Valve

THOUSANDS OF SAFE

"STOPS and STARTS"

day after day

hydraulic... automatic... manual

GOLDEN-ANDERSON

CUSHIONED

CHECK VALVES

Designed for safe, dependable control on the most difficult installation to eliminate serious surge and "Water Hammer"—to properly arrest reverse flow. GOLDEN-ANDERSON Cushioned Check Valves are specified on many of the most important new and replacement installations.

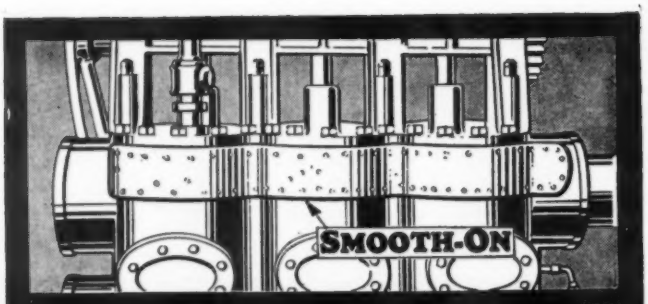
Write for informative technical catalog.

GA

GOLDEN-ANDERSON

VALVE Specialty Company

KEENAN BUILDING · PITTSBURGH 22, PA.



LEAKING STOPPED

in badly cracked cylinder block

A long crack developed in a 15" x 12" triplex geared power pump in a Tennessee plant. It extended through all valve chambers, valve decks and one partition between plunger cylinders. The Smooth-On repair shown above put the pump back in service.

First the entire crack was filled in with Smooth-On No. 1 Iron Repair Cement. Then a shaped metal patch, coated with Smooth-On, was bolted through valve chamber covers and valve decks into solid iron. After the Smooth-On had hardened, the pump resumed operation without leakage.

For more than 50 years, Smooth-On No. 1 has been a repair standby with mechanics, engineers and maintenance men, for sealing cracks, stopping leaks and tightening loose parts economically and effectively. It makes repairs that stay tight, because Smooth-On expands slightly as it sets to metallic hardness.

Order Smooth-On No. 1 in 1-, 5-, 25- or 100-lb. sizes from your supply house. If they haven't it, write us.

FREE POPULAR REPAIR HANDBOOK

Shows how to make many tested, practical, short-cut repairs on plant equipment, etc. 40 pages. 170 diagrams. Clear instructions. Pocket size—and should be in the pocket of every plant engineer and mechanic. Yours—for just sending the coupon.

Sign and Send Now

Smooth-On Manufacturing Co., Dept. 30
570 Communipaw Ave.
Jersey City 4, N. J.

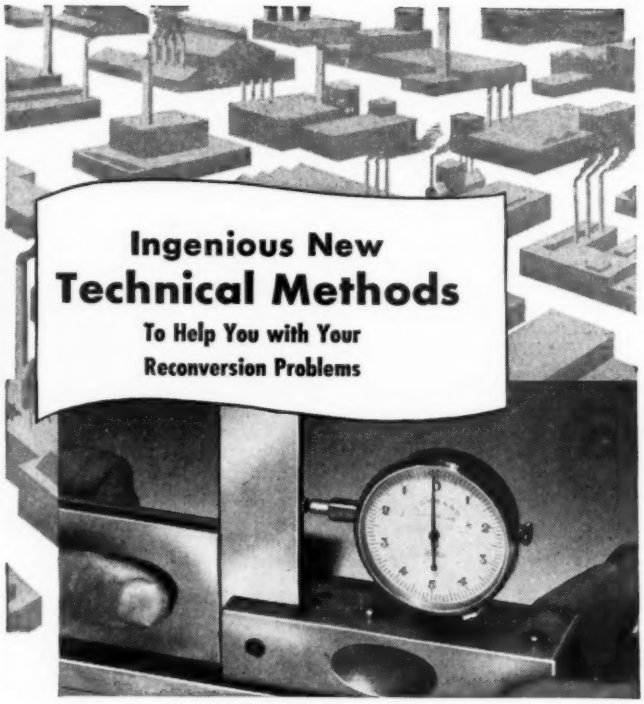
Please send me a Smooth-On Handbook

Name .....

Address .....

9-46 .....

Do it with SMOOTH-ON

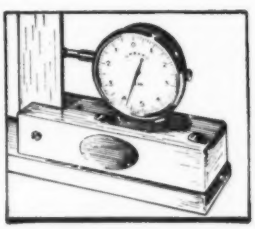


Ingenious New Technical Methods

To Help You with Your Reconversion Problems

New Micro Square Instantly Checks Right Angles to One 10,000th Inch!

Ideal for precision testing, the Acro Micro-Sine Square quickly and accurately checks right angle work to 1/10,000th inch within a given distance. Its standard indicator dial instantly registers error, location of error, and amount of correction required. Designed for tool and die shops, machine shops and testing laboratories, it also provides a standard for checking master squares, tri-squares and tools.



Standard Indicator Dial

The Acro Micro-Sine Square is very simple to operate, saves hours of time. Made of hardened tool steel, in ground and lapped precision construction. Available in two types: (1) Standard precision gauge in tenths, (2) Lever indicator in thousandths. Both complete with master checking blocks and carrying cases.

On precision jobs, requiring a static position and mental alertness, workers undergo nervous tension which often results in fatigue. Tests have shown that the act of chewing helps relieve tension—helps workers stay alert, thus increasing their efficiency to do more accurate work. For this reason, many plant owners urge workers to chew Wrigley's Spearmint Gum on this type of job.

You can get complete information from
Acro Tool and Die Works
4554 Broadway, Chicago 40, Illinois

AA-89

PROBLEM:— Installing a stack, dust collectors and dampers on two boilers and providing a bypass around the dust collectors, in the most compact space possible.

One Thermix Stack, serving both units, was connected to the boilers by a straight, short, horizontal breeching. Two SVH Heacon dampers regulated the flow through the dust collectors when partially open and, when fully opened, exposed the bypass. Two Thermix tubular dust collectors were easily installed by suspending them from the stack supports.

These units were all installed on a simple steel structure supported by the four boiler columns.

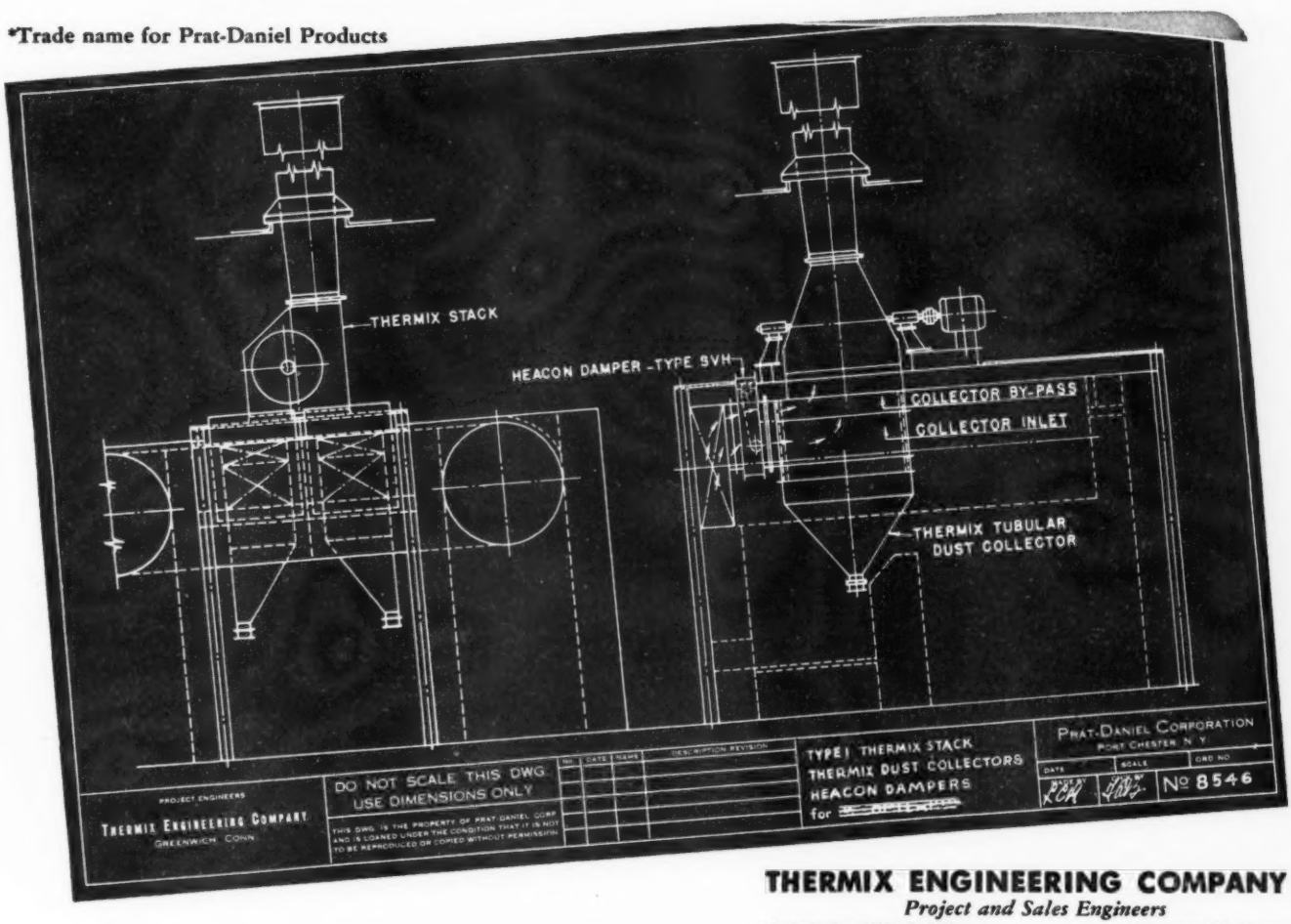
Thermix equipment is designed to simplify installation problems. The Thermix stack, for example, combines a stack breeching and I.D. fan in one integral unit that can be mounted directly on the boiler, or adjacent to the boiler, with a minimum of structural supports and duct work.

Our project engineers can simplify your installation problems. Write or call the office nearest you.

Simple- Direct- Efficient INSTALLATIONS

. . . are possible with "Thermix"* equipment

*Trade name for Prat-Daniel Products



THERMIX ENGINEERING COMPANY
Project and Sales Engineers
First National Bank Bldg. **Greenwich, Conn.**

PRAT-DANIEL CORPORATION

EAST PORT CHESTER, CONN.

PIPE-LINE or PNEUMATIC CONVEYORS for ASHES and FLY-ASH

"Most economical in steam-consumption and maintenance." Design of every part, fitting, etc., based on our experience of 25 years with the successful manufacture and operation of this type of conveyors and on our full appreciation of their special requirements.

We also specialize in improving existing conveyors through our superior fittings and frequently through rearrangement of present layouts.

CAST IRON SECTIONAL ASH TANKS, COAL BUNKERS, BINS, HOPPERS and SILOS

Durability combined with our exclusive discharge-efficient and self-clearing designs, preventing arching, packing and spontaneous combustion in case of coal bunkers and also obviating the necessity of hazardous trimming.

MECHANICAL SOOT BLOWERS for FIRE-TUBE BOILERS of ALL TYPES

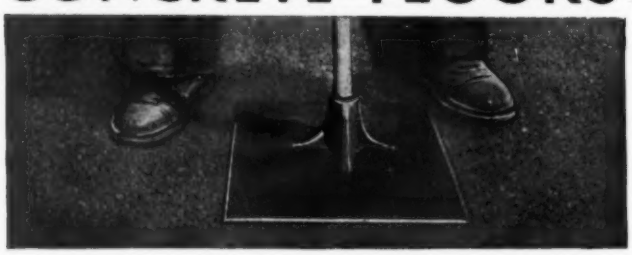
Fixed nozzle centered to each tube. No cutting of tube-sheet. No moving parts in hot boiler. All tubes in boiler blown with four successive puffs of steam or air in about one minute. Perfect soot-removal from each tube END TO END.

HAHN EQUIPMENT CORPORATION

(Formerly Hahn Engineering Company)

30 Church Street, New York 7, N. Y.

HERE'S THE NEW QUICK WAY TO FIX BROKEN CONCRETE FLOORS



Tamp! Truck Over! No Wait for Setting!

Use durable INSTANT-USE . . . a tough, plastic material which you simply shovel into hole—tamp—and run traffic over immediately. NO WAITING. Bonds tight to old concrete. Makes smooth, solid, heavy-duty patch. Withstands extreme loads. Keep a drum on hand for emergencies. Immediate shipment.

MAIL COUPON for **FREE TRIAL OFFER**

INSTANT-USE

FLEXROCK COMPANY
3677 Filbert St., Philadelphia 4, Pa.
Canadian Office: 21 King St., E, Toronto, Ont.
Please send me complete INSTANT-USE information and details of FREE TRIAL OFFER—no obligation.

Name .....
Company .....
Address .....

LOCKE
REDUCING VALVE *and* PUMP GOVERNOR

Now Available

- ★ Rugged Construction
- ★ Extreme Range
- ★ Direct Acting
- ★ Uniform Reduced Pressure
- ★ Cast or Composition Bronze
- ★ Extreme Sensitivity
- ★ Compact Size
- ★ Operates Smoothly
- ★ Sizes up to 2"
- ★ True, Even Pressure

For use as pump governor it will be furnished with a stuffing box that usually lasts the life of the governor. Initial Pressures up to 250 lbs. Reduced to 10 lbs. with 20 lb. range.

A catalogue or consultant available at your request.

DIVISION OF THE H T. WILSON MACHINE CO , INC.

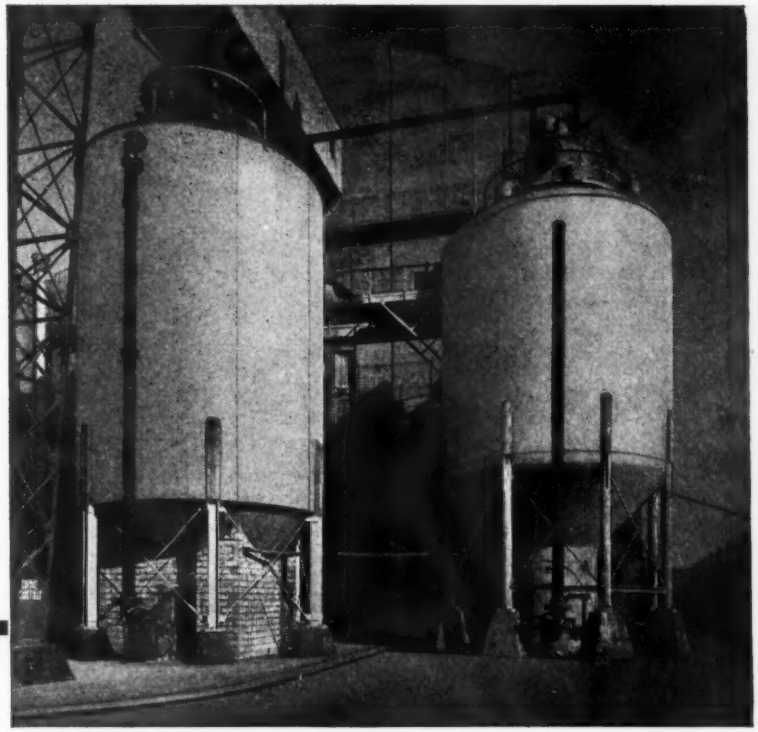
LOCKE REGULATOR COMPANY

WALTER AND OSBORNE STREETS
SALEM MASSACHUSETTS

PEACOCK BROS., LTD. • MONTREAL, CANADA
Canadian Representatives

Hydraulic Regulators • Damper Regulators • Fan Engine Regulators
Back Pressure Valves • Balanced Valves • Electric Valves
Reducing Controls • Pump Governors • Vacuum Breakers
Engine Stops • Master Regulators • Oil Control Valves
Solenoid Controls

70,000 GPH Phosphate Hot Process Water Softener installed in a Michigan chemical plant to supply feed water for boilers operating at 1500 psi.



WATER CONDITIONING *Facts* WORTH KNOWING

No. 1 in a series

THE REASONS FOR LIME AND SODA PHOSPHATE TREATMENT

Water produced by the lime and soda softener, hot process type, is softened to approximately one grain per gallon of hardness. This treated water is suitable for use in low pressure boilers as it will not deposit scale in the boilers, but leaves only a sludge which is easily washed out.

However, with boilers operating at high pressure and temperatures the compounds contained in this treated water are converted into scale forming solids, which are damaging to boilers and boiler feed equipment. To eliminate this scaling, secondary treatment with phosphate or phosphoric acid is required to produce water of zero hardness.

GRAVER HOT PROCESS WATER SOFTENER —LIME—SODA-ASH AND PHOSPHATE

This equipment is available as a combination in which the lime and soda softener and the phosphate softener are combined in a single unit. In this system the lower portion of the sedimentation tank is used for the lime and soda softening process. This softened water is then discharged into an upper compartment where the phosphate treatment takes place. From here the water enters the deaerator where the oxygen and free CO_2 gases it contains are removed. The water provided by this system is perfectly conditioned for boiler feed being of zero hardness and free from corrosive gases. The efficiency and economy of operation of this equipment makes it an extremely worthwhile investment.

ALSO AVAILABLE AS TWO SEPARATE UNITS

The Graver Hot Process Softener, Lime, Soda-Ash and Phosphate is also available as two separate units. One is used for the lime and soda processing only. The water from this tank is then delivered to a second sedimentation tank where the water is softened to zero hardness by the addition of phosphate or phosphoric acid. Following this treatment the water is deaerated, then filtered and delivered to the boiler feed pumps.

Graver engineers will gladly work with you on any water conditioning problems you may have without cost or obligation to you. Write, wire or phone for immediate attention.

GRAVER WATER CONDITIONING EQUIPMENT

Process Equipment Division of

GRAVER TANK & MFG. CO., INC.

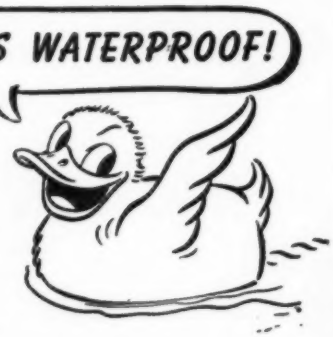
General Offices, 4809-25 Tod Ave., East Chicago, Ind.

NEW YORK CHICAGO CATASAUQUA, PA. PHILADELPHIA PITTSBURGH PORT ARTHUR SAND SPRINGS, OKLA.

Hot Process Water Softeners • Zeolite Water Softeners • Water Filters • Taste and Odor Removal Filters
Iron Removal Filters • Oil Removal Filters • Chemical Mixing and Proportioning Equipment

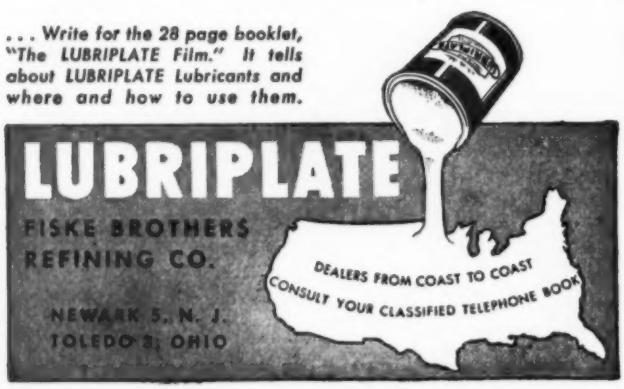
LUBRIPLATE

No. 107



This is a general purpose lubricant, one of the most popular in the LUBRIPLATE line. It is just the right density for general application by pressure guns or grease cups. No. 107, like other LUBRIPLATE products, arrests progressive wear, saves power, protects machines against rust and corrosion. It will pay you to try it. Let us send you a special bulletin telling how LUBRIPLATE is cutting down repairs in your industry.

. . . Write for the 28 page booklet, "The LUBRIPLATE Film." It tells about LUBRIPLATE Lubricants and where and how to use them.



HOPPES

FEEDWATER HEATERS

Deaerating and Non-Deaerating

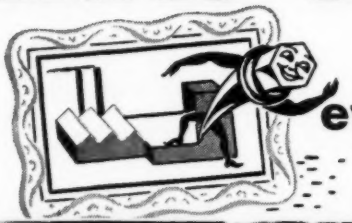
Write for Bulletin

THE HOPPES MFG. CO.

Established 1881

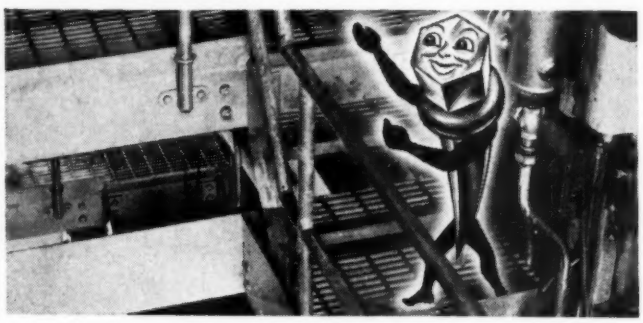
SPRINGFIELD OHIO

BATES • GRATES



fit into every plant picture

If yours is an application like this—with pipes, installations and stairways cutting into the area—BATES • GRATES will give you neat, safe and strong open steel flooring.



Here's where BATES • GRATES win universal approval—where a series of stairways combine with short walkways. Safe and strong, plenty of light and ventilation all the way down.

YOU can use BATES • GRATES for flooring any area or running any stairways. They serve to advantage in many ways: They are strong, safe, easy to maintain, durable, provide maximum lighting and ventilation.

The simple directness of BATES • GRATES engineering accounts for these advantages. The key is the Hex Cross bar fillet-welded to stout main bars.

For open steel flooring and stair treads in your plant . . . *Get a Bid from BATES*

PUMPING *Service* TO YOU

on a Nation-wide Basis

Alert to the fact that engineers the country over are anxious to modernize their pumping equipment as soon as possible, Warren is making an all-out effort to cooperate.

Our engineering and manufacturing facilities have been enlarged . . . our nation-wide network of agencies increased. These agencies are staffed by trained, experienced men . . . ready to give you on-the-spot service.

Warren engineers are pump specialists, having spent many years in this field exclusively, and they are in a position to give you expert, cooperative advice. WRITE DIRECT to our home office, Warren, Massachusetts, giving all possible information as to operating conditions and desired results.

P-6

WARREN STEAM PUMP COMPANY, INC. • WARREN, MASSACHUSETTS

Warren Pumps

CENTRIFUGAL AND RECIPROCATING

For: Power Plants — Chemical Plants — Paper Mills — Food Industries — Metal Working — Oil and Mining Services

This is Inland 4-Way Floor Plate

Yes, this is Inland 4-Way Floor Plate ... that safe, dependable steel flooring that guards against dangerous slips and falls ... and lasts for years and years.

For floors, steps, walkways, platforms and elevator hatchways, it provides structural strength and safety. The attractive 4-way pattern cleans easily and drains freely.

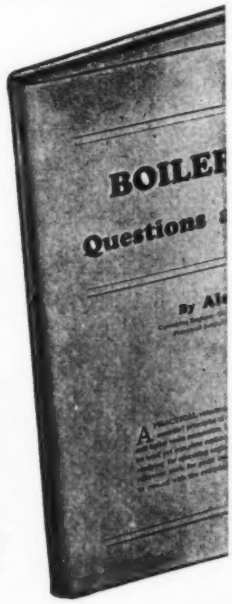
If your plant, building or product needs added safety under foot or wheel, you'll want to know more about Inland 4-Way Floor Plate ... Available for immediate delivery from conveniently located steel warehouse distributors.

SAFE, ECONOMICAL
EASY TO INSTALL
Write for Catalog

INLAND STEEL COMPANY
38 S. Dearborn Street — Chicago 3, Ill.
Sales Offices: Detroit, Indianapolis, Kansas City, Milwaukee, New York, St. Louis, St. Paul

Master STEAM-BOILER principles of design, construction and operation

with this concise, readable, understandable question-and-answer treatment



A practical book for the operating engineer—giving him clear, concise questions and answers for a comprehensive view of boiler-room principles and practice.

HERE is a clear, simple way to learn the principles underlying the design, construction and operation of steam boilers and their accessories. These direct, point-by-point questions and answers are designed particularly to help practical power plant men and students studying for operating engineers' certificates, and to provide ready reference material for all those concerned with everyday power plant problems.

BOILER ROOM Questions and Answers

By ALEX HIGGINS

Consulting Engineer; Director, Engineering Extension Courses, Provisional Institute of Technology and Art, Calgary, Alberta; Licensed Chief Engineer.

139 pages, 9 x 12, 184 illustrations, $3.00

NOW, here in convenient book form are the review questions and answers that *Power* readers received so enthusiastically in serial form. Get a comprehensive survey of typical examination questions—thoroughly covering the wide range of topics of major importance to the operating engineer—clearly explained in readable, easily learned form. Emphasizes sound principles rather than minute details. Includes hundreds of useful tables, definitions, formulas, computations—amply illustrated by 184 sketches and diagrams.

Be prepared for written examinations with 570 practical questions and answers on these important topics—

Boiler Regulations
Construction Materials and Details
Steam Gauges and Water Columns
Safety Devices
Typical Boiler Repairs
Facts about Fuels
Draft and Its Control
Hand and Stoker Firing
Feed-water Heating
Pumping Problems
Pipe and Piping Accessories
Steam Tables

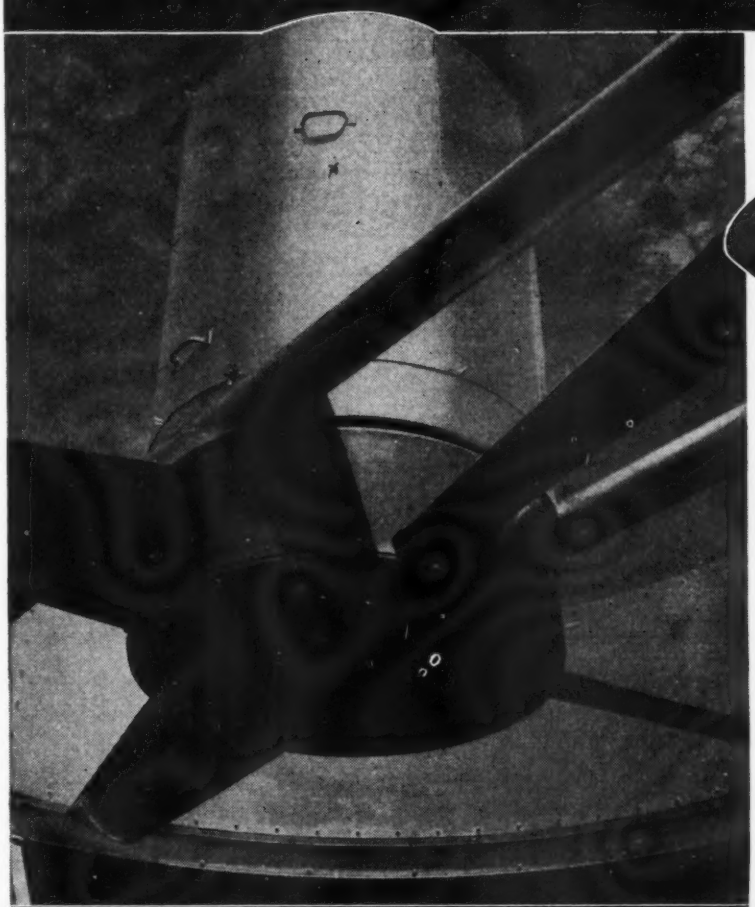
See a copy 10 days FREE

McGRAW-HILL FREE EXAMINATION COUPON

McGraw-Hill Book Co., 330 W. 42nd St., N. Y. C. 18
Send me Higgins' Boiler Room Questions and Answers for 10 days' examination on approval. In 10 days I will send $3.00, plus few cents postage, or return book postpaid. (Postage paid on cash orders.)

Name .....
Address .....
City and State .....
Company .....
Position .....P 9-46
For Canadian price write: Embassy Book Co., 12 Richmond St. E., Toronto 1

The *EXTRA VALUES* You Receive from Pritchard Cooling Towers



Patented Pritchard SEALDFLOW fan drive over FEATHERWEIGHT (Monel metal) induced draft fan

result from

features like these

FANS extremely light in weight, requiring less power. True airfoil blades of corrosion-resisting wrought Monel welded to a rugged internal frame, with pitch adjustable to permit optimum setting for any tower loading. Other advantages worthy of examination.

DRIVES composed of integral vertical gearhead motors, eliminating right angle gears, flexible couplings and alignment problems. Write for complete information.

DISTRIBUTING SYSTEM that is the most lastingly trouble-free yet devised. All-redwood, capable of 100% overload with completely uniform water distribution. Get the full facts on its unique design.

AIR-INTAKE SYSTEM that applies sound and progressive engineering to air inlets, to the benefit of air distribution and the virtual elimination of winter troubles. 5 different arrangements available at same price. Let us give you the details.

STRUCTURAL STRENGTH that is second to none, employing more redwood and LESS corrodable iron and steel; skillful use of ample diagonals, ring connectors, angle washers, etc. The "fine points" of Pritchard construction merit your closer study.

DECKING-that achieves ideal water break-up over its entire cubic area and remains permanently level.

DELIVERY DATES that carry the assurance, based on a consistent history, of completion promises and performance guarantees being met or bettered.

On all these points, and for towers of all sizes and types, Pritchard has an outstanding record to show you, worthy of your inquiry. Write or call the office near you.

EQUIPMENT DIVISION, Fidelity Bldg., Kansas City 6, Mo.

Pritchard EQUIPMENT

THE LINK TO BETTER PERFORMANCE

- "Airdfin" Air-Cooled Heat Exchangers
- Cooling Towers, All Types and Capacities
- Shell & Tube and Atmospheric Heat Exchangers
- "Hydryer" Air and Gas Drying Units
- "3-Zone" Cleaners and Separators for Air, Gas and Steam
- Air Treaters for Purification and Positive Control of Moisture and Temperature in Air Conditioning Systems

For more information, see Sweets Files, Chemical Engineering Catalog, Refinery Catalog, ASH&VE Guide or ASRE Data Book

NEW YORK, CHICAGO, LOS ANGELES, DETROIT, PITTSBURGH, ST. LOUIS, HOUSTON, TULSA, ST. PAUL, OMAHA, DENVER, ATLANTA, SALT LAKE CITY, EL PASO, MEXICO CITY

J.F. Pritchard & Co.

ENGINEERS • CONSTRUCTORS • MANUFACTURERS

for the CHEMICAL, PETROLEUM, GAS & POWER industries

PROFESSIONAL SERVICES

CONSULTING · DESIGN · EXAMINATIONS · PATENTS
CONSTRUCTION · PLANS · SURVEY • REPORTS · TRADE MARKS

ASSOCIATED ENGINEERS, Inc.
Joseph C. Lewis, *President*
230 E. Berry St., Fort Wayne 2, Ind.
Management Consultants
Engineering • • Architecture • • Accounting
Organization • • Methods • • Costs

KEGARISE-CRONK ENGINEERING CORP.
Engineers - Consultants
Power Plants — Industrial Plants
Steam and Electric Distribution Systems
Steam and Electric Utilization
Design — Reports — Plans
334 E. Main St. *P.O. Box 668* Johnson City, Tenn.

J. E. SIRRINE & COMPANY
Power Plants · Design · Water
Engineers
Steam Utilization
Consultation · Reports · Plans
Greenville South Carolina

ASSOCIATED ENGINEERING ANALYSIS
CONSULTANTS IN INDUSTRIAL TECHNICS
ENGINEERS MATHEMATICIANS PHYSICISTS
Designing · Research · Optics
Time Study · Nomograms · Research
Plant Layout · Charts, Graphs · Acoustics
Work Simplification · Cam-Linkage- · Electronics
Methods Improvement · Computations · Development
Practical Solutions to Theoretical Problems
215 Montague St., Brooklyn 2, N. Y. at Boro Hall

LUKE L. NAKASHIAN
Engineer
PROCESS STEAM PLANTS
POWER PLANTS
OIL REFINERY EQUIPMENT
404 Park Square Building. Boston 16, Mass.

STANLEY ENGINEERING COMPANY
CONSULTING ENGINEERS
Power Plants
Steam - Diesel - Hydro
Design - Construction - Test - Valuation
Central State Bank Bldg., Muscatine, Ia.

H. E. CORL
CONSULTING ENGINEER
Design Supervision of Construction Management
Industrial and Municipal Power Plants
Steam and Diesel
Steam and Electric Power Distribution Systems
Plants surveys Appraisals Reports
1505 Race Street Philadelphia, Pa.

PUBLIC UTILITY ENGINEERING & SERVICE CORPORATION
CONSULTING ENGINEER
Design Operations
Steam - Hydraulic - Gas
231 S. LaSalle St., Chicago (4), Ill.

JOHN A. STEVENS
Established 1909
CONSULTING ENGINEERS
Power Plants · Paper Mills
Dye Houses · Surveys
Lowell, Massachusetts

E. R. GARLOCK & ASSOCIATES INC.
Industrial Mechanical & Electrical Maintenance Engineers
Complete plant and power maintenance, rehabilitation, installation, construction, inspection, performance and efficiency supervision.—Emergency repairs. High pressure power units a specialty.
201-202 Delaware Bldg. Akron 8, Ohio

REYNOLDS, SMITH AND HILLS
ENGINEERING CONSULTANTS
Specialists in Design and Construction of Industrial and Central Station Plants
Reports, Analyses and Surveys
10 South Laura St. Jacksonville, Fla.

THE J. G. WHITE ENGINEERING CORPORATION
Design • Construction • Reports • Appraisal
80 Broad Street, New York 4

GILBERT ASSOCIATES, INC.
ENGINEERS AND CONSULTANTS
Industrial and Utilities
Power Plant Design and Construction
Rehabilitation and Maintenance
Steam — Diesel — Hydro
Reports—Examinations—Laboratory
61 Broadway, New York
1417 K Str. N.W. Washington, D. C.
17 & Sansom St., Phila., Pa.

SANDERSON & PORTER
ENGINEERS
AND
CONSTRUCTORS

WHITMAN, REQUARDT AND ASSOCIATES
Engineers - Consultants
Power Plants — Industrial Plants
Steam and Electric Distribution Systems
Waterworks and Sewerage
Reports—Plants—Supervision—Appraisals
1304 St. Paul Street Baltimore 2, Md

HALL LABORATORIES, Inc.
R. H. HALL, Ph.D., Director
CONSULTANTS ON
BOILER WATER CONDITIONING
Hagan Building Pittsburgh (30), Pa.

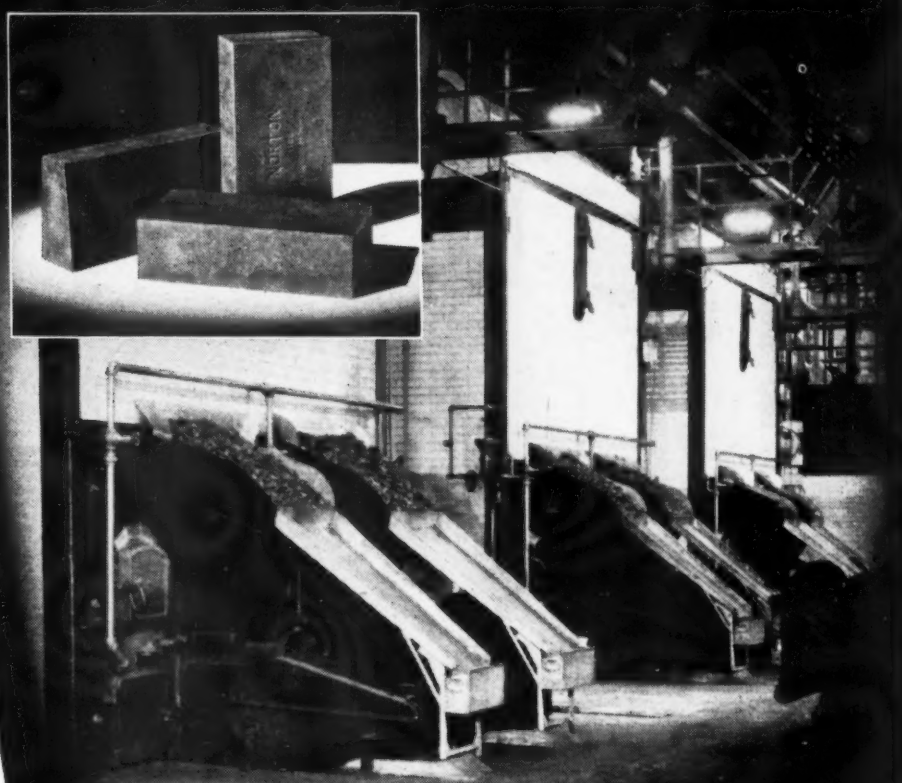
SARGENT & LUNDY
ENGINEERS
140 South Dearborn St.
CHICAGO, ILLINOIS

Can Money Be Saved in Your Plant?
The specialists whose professional cards appear in this Directory, can answer that question —*are* answering it continually for other power men.

THE REAL *VALUE*

of placing your unusual problem in the hands of a competent consultant eliminates the elements of chance and uncertainty from the problem and provides real facts upon which to base decisions.

CRYSTOLON BRICK - Give to Boiler Furnaces a Refractory Lining that Stands the Gaff... Cuts Fuel and Maintenance Costs



"The high refractoriness, physical ruggedness and chemical stability of crystolon brick plus the resistance of their hard dense surface to clinker adherance and to abrasion provides a refractory lining for boiler furnaces which pleases the power plant operators by providing a maximum of service with a minimum of down-time for repairs. The resistance of crystolon brick to penetration or corrosion by slag brings economies in the way of increased operating efficiency, faster clinker removal and lower maintenance costs.

NORTON COMPANY, WORCESTER 6 MASSACHUSETTS

"Crystolon is the registered trade-mark for Norton Company's Silicon Carbide".

Norton Longer Lasting Refractories

VIKING

FEATURES THAT MAKE FOR GOOD PUMPING

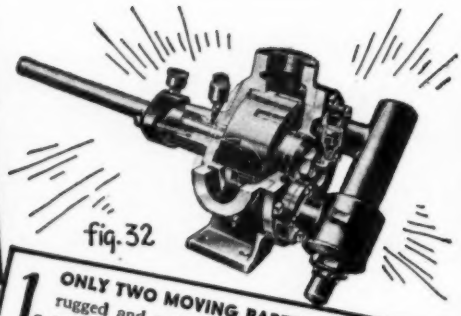


fig. 32

1. **ONLY TWO MOVING PARTS.** Both large and rugged and each self supported. No small intricate parts requiring frequent replacement.

2. **SELF PRIMING** on suction lifts up to 20 feet or vaporization limits on volatile liquids. Smooth, even discharge. No pulsation.

3. **SLOW SPEED—LONG LIFE.** Reduced speeds of Viking pumps prolongs life and still retains large volume.

4. **OPERATES IN BOTH DIRECTIONS.** Viking pumps operate equally well in both directions. Simplifies ordering, installation.

5. **SINGLE STUFFING BOX.** Long, leak resistant stuffing box. Easily serviced.

Get the complete story on VIKING PUMPS for the power equipment field today. Send for free copy of Bulletin Series 46SW.

See Our Catalog In SWEETS

VIKING PUMP COMPANY
CEDAR FALLS, IOWA

TO HELP YOU WITH FUTURE POWER PLANNING

Special section on

GAS TURBINES

OCTOBER—POWER

20 pages summarizing the latest developments in this field.

(Note: This section was formerly scheduled for September POWER.)

WHERE TO BUY

Featuring additional products specialties and services for power plants

End Pump Troubles!

HILL IMPROVED PUMP VALVES

• The valve with the renewable feature restores old pumps to original efficiency. Constant contact is maintained over the full bearing surface no matter in what position the valve rotates because of the exclusive HILL design. Efficient, durable, economical, accurate. Send today for bulletin that tells how to get better pump performance.

HILL PUMP VALVE CO.
2728 ELSTON AVE. CHICAGO 47, ILL.

TEST SPEEDS and SAVE at a glance
REVOLUTIONS and FEET per min.
SPEED VARIATIONS
BELT SLIPPAGE
Send for Bulletin

O-Z Improved Hand Tachometer-Cutmeter
O. ZERNICKOW CO.
21 Park Row New York 7

"MONO"
BOILER BAFFLES
HIGH TEMPERATURE
Refractory Cements
SANFORD C. SMITH REFRACTORIES, INC.
1715 NIAGARA ST., BUFFALO, N. Y.

THE ORIGINAL
Tripp Metallic Packing
TRIPP METALLIC PACKING CO.
BOSTON MASS.

Automatic Control

POWERS TEMPERATURE and HUMIDITY CONTROL

For Industrial Processes, Heating and Air Conditioning Systems, Hot Water Heaters and Shower Baths. Write for Bulletins.
Offices in 47 Cities
2771S Greenview Ave., Chicago, Ill.
THE POWERS REGULATOR CO.

This WHERE TO BUY *Section*

supplements other advertising in this issue with these additional announcements of products and services essential to efficient and economical power operation and maintenance. Make a habit of checking this page, each issue.

Classified Advertising Division
POWER

Wiedeke Ideal Tube Expanders

Fig. 40 Ideal Ace Tube Expanders, used for most types of Stationary, Locomotive and other Fire Return Tubular Steam Boilers. In 52 years of rolling they have achieved a most enviable record for service, economy and durability.

WIEDEKE IDEAL FLUE TOOLS DAYTON

TRADE MARK ASSURANCE OF QUALITY

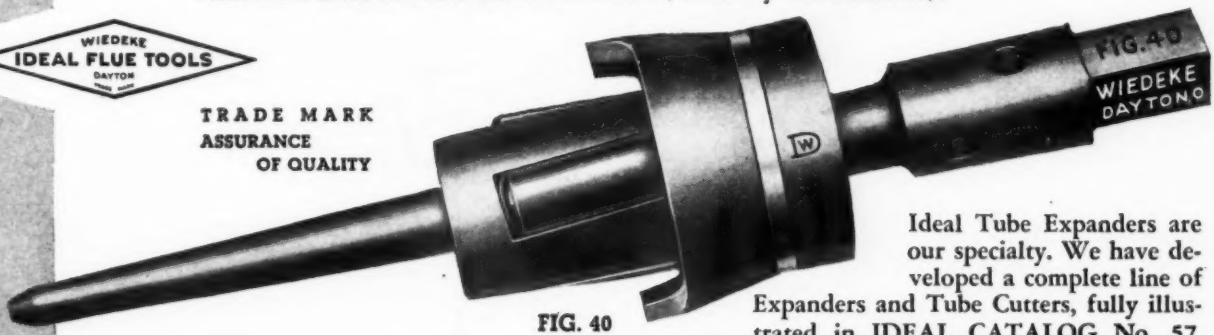
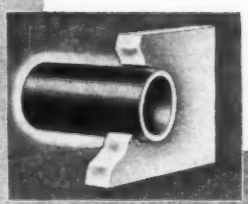
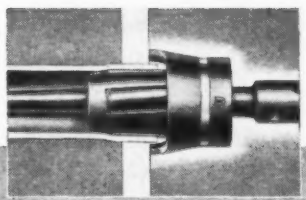


FIG. 40

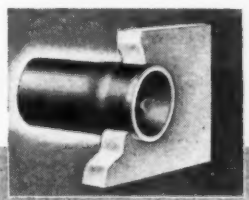
Ideal Tube Expanders are our specialty. We have developed a complete line of Expanders and Tube Cutters, fully illustrated in IDEAL CATALOG No. 57.



Tube set in sheet with proper projection for bead.



Tube rolled steam tight in sheet.



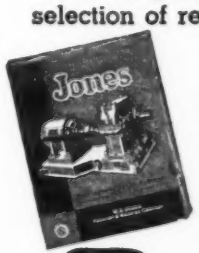
Tube ready to be beaded.

The Gustav Wiedeke Company

DAYTON 1, OHIO · U.S.A.

You can get what you want in the complete range of Jones Herringbone Speed Reducers

YOU will find this 128-page catalog of Jones Herringbone Speed Reducers helpful in the selection of reducers in accordance with A.G.M.A. recommended practice for all conditions of service. Jones Herringbone Speed Reducers are built in single, double and triple reduction types and in every standard ratio in ratings ranging from 1.25 H.P. to 440 H.P.



All these reducers have heat treated gears, ground shafts and are mounted with anti-friction bearings throughout. Liberal stocks are carried to facilitate shipments.

Catalog No. 70 will save you time and effort in laying out drives that call for Herringbone gears.

WRITE FOR YOUR FREE COPY

W. A. JONES FOUNDRY & MACHINE CO., 4423 Roosevelt Rd., Chicago, Ill.

Jones HERRINGBONE—WORM—SPUR—GEAR SPEED REDUCERS • PULLEYS
CUT AND MOLDED TOOTH GEARS • V-BELT SHEAVES • ANTI-FRICTION
PILLOW BLOCKS • FRICTION CLUTCHES • TRANSMISSION APPLIANCES

AS QUICK AS A FLASH YOU CAN KNOW THE EXACT MEASUREMENT OF YOUR VALUABLE STORED LIQUIDS With **LIQUIDOMETER** *Tank Gauges*

WRITE for COMPLETE DETAILS

"LIQUIDS WORTH STORING ARE WORTH MEASURING"

THE **LIQUIDOMETER** CORP.
39-16 SKILLMAN AVE., LONG ISLAND CITY, L.N.Y.

These Handbook Sections Will Help You in Future Power Planning

IN *October*—GAS TURBINES

20 pages summarizing latest developments in this field

IN *December*—STEAM GENERATORS

48 pages of "how-to" information on boilers and furnaces — types, applications, trends.

For significant, cost-saving help on all phases of power engineering, read

POWER

330 West 42nd St., New York 18, N. Y.

ONLY 1 REASON

WHY YOU USE PACKINGS

There is only one reason why you use packings—and that is to prevent leakage somewhere.

Every engineer is aware that in many instances the labor cost is higher when making replacements than the actual cost of the packing.

Right here is where

QUAKER

Packings can help you

REG. U.S. PAT. OFF.

Quaker began manufacturing rod packings when engines were simple and pressures were low.

With the advancement of all types of industrial equipment Quaker has kept abreast with a line of rod packings to meet any present day conditions.

By the use of Quaker Packings you are assured of long service. Technical and practical experience of proper manufacturing which includes the vital part of correct lubrication, enables Quaker to offer a line of Rod Packings that will prove economical because of the long life—making frequent repacking unnecessary, and the cost of the packings is very moderate.

Quaker Packings are sold by leading Mill Supply Houses and Hardware Dealers all over the country. Specify Quaker and buy through your local source of supply.

"If there is a way to get it done—Quaker will do it"

QUAKER RUBBER CORPORATION

Mfrs. Industrial Rubber Products

PHILADELPHIA 24, PENNSYLVANIA

NEW YORK • CHICAGO • CLEVELAND • HOUSTON

Western Territory

Quaker Pacific Rubber Company

San Francisco • Los Angeles

WANTED

STRUCTURAL ENGINEER

For Design of Structural Steel and Reinforced Concrete Structures

An unusual opportunity for a young man experienced in the design of structural steel and reinforced concrete to join a growing organization.

WESTCOTT & MAPES, INC.
New Haven, Connecticut

DRAFTSMEN

DESIGNERS AND CHECKERS
with experience on
Structural Steel and Concrete
Process Piping
Pressure Vessels

The Boston office of E. B. Badger and Sons Co., internationally famous chemical engineering organization, offers qualified men well-paying positions. This is a fine opportunity for men who would enjoy working in congenial surroundings and with pleasant cooperative associates. A personal interview can be arranged in your city. This is not a temporary position. Write, giving full details of background and experience, salary wanted, etc., to

Mr. William M. Rose, Personnel Director
E. B. Badger and Sons Co.
75 Pitts Street, Boston, Mass.

WANTED

ELECTRICAL ENGINEER

For Power Plant Design
Must have Public Utility Experience

WESTCOTT & MAPES, INC.
New Haven, Connecticut

ARE YOU THE MAN?

A fast growing organization needs a man to take charge of the buying and selling of used electrical machinery. Department already established.

Compensation adequate to attract the right man.

Write stating age and past experience. All letters kept in strict confidence.

P-178, Power
330 West 42nd Street, New York 18, N. Y.

POSITIONS VACANT

OPPORTUNITY FOR Machine designers, electrical designers, or piping lay-out men with industrial experience. Large manufacturer in small eastern Penna. city. Write full details about age, experience, etc. to P-179, Power, 330 W. 42nd St., New York 18, N. Y.

WANTED: WATCH Engineers for boiler house of large manufacturing plant. Must be experienced in operation and maintenance of large coal burning boilers. Mechanical engineering degree preferred, but may be offset by adequate experience. P-180, Power, 330 W. 42nd St., New York 18, N. Y.

EMPLOYMENT SERVICE

SALARIED POSITIONS $2,500-$25,000. This thoroughly organized confidential service of 36 years' recognized standing and reputation carries on preliminary negotiations for supervisory, technical and executive positions of the calibre indicated, through a procedure individualized to each client's requirements. Retaining fee protected by refund provision. Identity covered and present position protected. Send only name and address for details. R. W. Bixby, Inc., 270 Dun Bldg., Buffalo 2, N. Y.

POSITIONS WANTED

GRADUATE MECHANICAL Engineer: 39, former Army Engineer Corps officer. Ten years operating, design and supervisory experience power plant and plant utilities systems. Four years design, planning and construction supervision of military construction. Now employed but housing conditions unacceptable. Desires responsibile position in power plant, municipal service or technical sales. PW-181, Power, 520 N. Michigan Ave., Chicago 11, Ill.

POWER ENGINEER: age 31, desires permanent connection with engineering firm or engineering dept. of industrial concern. Master's degree and ten years experience in modern power plant engineering, operation and maintenance. PW-182, Power, 330 W. 42nd St., New York 18, N. Y.

SALES SPECIALIST: Young mature mechanical engineering graduate has been factory service and sales specialist in midwest eight years. Concentrated on highest pressure mechanical boiler trim. Worked individually and with salesman and managers. Previously was industrial and distributor salesman. Want opportunity anywhere to create, regain and hold business. Confidential. PW-183, Power, 520 N. Michigan Ave., Chicago 11, Ill.

REGISTERED MECHANICAL Engineer: age 36, desires permanent position as superintendent of power or assistant plant engineer in an industrial plant. Experience: fifteen years in supervision, operation and maintenance of high pressure steam turbo-generating equipment. Location, preferably the middlewest. Best references. PW-184, Power, 520 N. Michigan Ave., Chicago 11, Ill.

SELLING OPPORTUNITIES WANTED

NORTHERN ILLINOIS and WISCONSIN. Professional engineer well acquainted with leading power plants in this territory wants one or two additional high-grade lines. RA-171, Power, 520 N. Michigan Ave., Chicago 11, Ill.

MANUFACTURERS AGENT: in New England and metropolitan New York City; 20 years experience in industrial field; former sales manager reestablishing after Army wants one additional specialty line mechanical or electrical field. Sales volume guaranteed. RA-185, Power, 330 W. 42nd St., New York 18, N. Y.

FREE BULLETIN

"SURPLUS PROPERTY"—How-What-Where: A 32 page 5x8 indexed booklet giving complete information on the purchase of government surplus in all available classifications. Write the Office of Information—War Assets Administration, Washington 25, D. C.

AIRCRAFT GAS TURBINE RESEARCH PROJECT

Opportunties for

AERODYNAMICIST — Mathematician exp. in theoretical and practical application of aerodynamics to elastic fluid mechanisms.

THERMODYNAMICIST — Exp. in combustion, heat balance, heat transfer, etc.

RESEARCH ENGRS.—Exp. in stress and vibration analysis of high speed machinery.

DESIGN ENGRS. & DRAFTSMEN—Exp. in aircraft power plant design.

WRITE NOW to Personnel Director—Give full particulars—educ., exp., base salary, etc.

DE LAVAL STEAM TURBINE COMPANY
Trenton, 2, New Jersey

STEAM POWER PLANT SUPERINTENDENT

Competent and conscientious Engineer desires position as STEAM POWER PLANT SUPERINTENDENT or equivalent. Age 43. Two years Technical College. Over 20 years diversified experience mostly supervisory capacity on Efficient Operation, Maintenance, and Overhaul of modern steam installations from low to 1400# pressure. Powdered Coal, Gas, Oil and Stoker fired, together with all auxiliaries. Desire change after lengthy service with present employer. Available on reasonable notice.

PW-175, Power
520 North Michigan Ave., Chicago 11, Ill.

EXPORT

EXEC. SALES ENGINEER

M. E. German Degree, Age 45

20 years experience in international trade. World wide travel. Six languages including Spanish and Russian. Available in 3 months. $9,000.

PW-176, Power
330 West 42nd Street, New York 18, N. Y.

WANTED

Technical Representation

A complete line of water conditioning equipment, chemicals and engineering service is available to those who can qualify with the proper technical, sales and financial background. This is a very valuable franchise covering the entire scope of water conditioning field with many highly lucrative areas open. In reply state fully technical experience, background and territory desired.

RW-174, Power
330 West 42nd St., New York 18, N. Y.

ERECTING ENGINEER

Erecting and Service Engineer experienced in supervising handling of heavy equipment, alignment, bearing adjustment, and general steam power plant practices. Good opportunity for qualified man with old established manufacturer.

P-173, Power
330 West 42nd St., New York 18, N. Y.

WANTED

Sales Representatives

Have a few good territory openings for aggressive sales representatives. An old established line of plastic insulation that has been proven successful on all types of boilers, boiler-room equipment, tanks, pipes, furnaces of all types, open hearth, reheat, etc. The line is well advertised and backed by an old, well-financed corporation. This is a real opportunity. State experience and territory wanted. Address

RW-162, Power
520 North Michigan Ave., Chicago 11, Ill.

(Additional Selling Opportunity & Wanted Advertising on page 344)

Dependable Rebuilt Electrical Equipment

1 YEAR GUARANTEE

3 Ph. Squirrel Cage Motors

Qu.	H.P.	Make		Speed
2	150	Howell	BB	1750
1	147	West.	25 cyc.	715
1	60	Burke		690
1	50	West.	CCL	1150
1	50	Cr. Wh.	1220	1150
1	50	West.	CS	580
1	50	G.E.	KT	580
1	50	G.E.	I-14	495
1	40	Triumph	TR	690
1	35	Wagner		850
1	30	U.S.	Vert.	3450
1	30	Cr. Wh.		870
1	30	Watson		850
1	30	West.	CCL	690
1	25	Wagner	Fy. Welch.	1200
1	25	Wagner	Vert.	1160
1	25	G.E.	IK	870
2-20/10		West.	XP	1160/580
1-20/10		West.	XP	885/440
1	20	G.E.	KT-312	1700
1	20	G.E.	Vert.	1750
1	20	R & M	K-207	1160
1	20	G.E.	Vert.	1175
1	20	Al. Ch.		870
1	15	Wagner	Fy. Welch.	1800
1	15	G.E.	KT-312	1150
1	15	Howell		1150
1	15	Al. Ch.		1150
1	15	G.E.	Vert.	1150
1	15	Lincoln		1150
	15	West.	MS	1150
1	15	G.E.	Vert.	870
1	15	Wagner	15VPR	860
1	15	Wagner	Fy. Welch.	720
1	15	West.	CS-504	415

2 Ph. Squirrel Cage Motors

Qu.	H.P.	Make		Speed
1	50	Lincoln	C-15	870
1	50	G.E.	IQ	870
1	40	Al. Ch.		870
1	30	West.	CCL	1150
1	25	Burke		870
3	25	G.E.	IQL	1150
1	25	West.	CCL	1150
1	15	G.E.	KQ-502	1150
1	15	West.	CS	1155
1	15	Al. Ch.		1130
1	15	West.	CS-572	860
1	15	G.E.	IQ	690

A.C. Slip Ring Motors

Qu.	H.P.	Make	Type	Speed
1	200	G.E.		1200
1	112	G.E.	ITC	720
1	75	West.	CW	600
1	75	Al. Ch.	Hoist	575
1	64	G.E.	MTO-552	585
1	50	G.E.	MT 2300 V.	600
1	52	G.E.	ITC	860

LEEDS & NORTHRUP MICROMAX

INDICATING THERMOCOUPLE PYROMETERS

Model S Recorders
Model C Controllers
Model R Recorders

Some New—
All Others Equal to New

1	50	Al. Ch.		865
1	50	G.E.	MT-342	860
1	40	West.	HF	850
1	40	G.E.	MT 2300 V.	570
1	35	Al. Ch.		870
1	30	G.E.	ITC	1200
1	30	G.E.	MQ-332	870
1	30	West.	CI-574A	870
4	30	West.	CI-582C	870
2	30	G.E.	MT-542	690
1	25	Al. Ch.		870
1	25	Howell	SRS-420	870
1	25	G.E.	1M	565
1	20	West.	CW	870
1	15	West.	CW	870
1	15	G.E.	MT-512	845
1	15	Al. Ch.		680
1	15	G.E.	MQ-332	670

A.C. Generators

Qu.	KW.	Make	Voltage	Speed
1	150	G.E.	220/440	1200
1	150	G.E.	240/480	600
1	133	West.	G	1200
1	106	El-Mchy	208/120	1200
1	100	West.	240/480	600
2	30	Century	208/120	1200

230 Volt D.C. Motors

Qu.	H.P.	Make	Type	Speed
1	350	West.	SK	340/425
1	125	West.	SK190	600
1	100	West.	SK180	625
1	75	West.	SK180	475
5	60	West.	SK160	680
1	60	G.E.	C-Inter.	480/1100
1	50	G.E.	RC-19	400/1200
1	45	Diehl	K-10	850
1	40	G.E.	DLC	1050
2	35	West.	SK-120	1150
1	35	G.E.	RLC-204	440/800
2	35	West.	SK-160	400/600
1	30	G.E.	RC-32	1100
1	30	West.	SA	500/1500
1	25	G.E.	RC-31	1150
1	25	West.	SK	1100
1	25	Reliance	92T	1150
1	25	Al. Ch.		850
1	25	Rel.	MS	500/1500
1	25	G.E.	RF	400/1200
3	20	G.E.	RF	500/1500
1	20	G.E.	RF	400/1200
1	20	G.E.	CD-83	1200
1	20	R. & M.		1160
1	20	El. Dyn.	7½-S	950
1	20	West.	Hoist	700
1	15	Rochester		3450
1	15	West.	SK-83	1150
2	15	G.E.	RC	1150
1	15	G.E.	CD-Vert.	900
1	15	G.E.	CD-85	850
2	15	G.E.	RC-30	850
1	15	Reliance	T155	400/1600
1	15	Sprague	D	700
1	15	West.	SK	675/1350
1	15	West.	SK-100L	600/2500
2	15	West.	SK	500/1500
1	9	L-A	Baler	1750
4	10	G.E.	RC	1150
2	10	G.E.	CD-75	1150
1	10	Diehl		900
1	10	G.E.	RC	29/850
1	10	G.E.	CD-83	850
1	10	Roth		800
1	10	Diehl	LS-14	750
1	10	West.	Elevator	700
1	10	G.E.	CVC	700
1	10	West.	SK	600/1200
1	10	G.E.	RLC	500/1500
1	10	West.	SK	500/1500
1	10	El. Dyn.		450/1800
2	10	West.	SA	400/1200
1	10	West.	SK-90	400/1200
1	10	Diehl		200/247
1	7½	Sturt.	TF	3600
1	7½	El. Dyn.	2S	1750
1	7½	G.E.	RC	1150
6	7½	West.	SK-40	1180
1	7½	G.E.	CO-1504	
1	8	L-A	Baler	1200
2	7½	West.	SK	850
2	7½	G.E.	RC	850
1	7½	West.	SK-60	850
2	7½	G.E.	RF-9	600/1800
1	7½	G.E.	RF-10A	600/1500
1	7½	West.	SK-90	650/1300
1	7½	El. Dyn.	3S	550/1650
1	7½	G.E.	RF-10	450/1800
1	7½	G.E.	RF-10	450/1600
1	7½	G.E.	RF	450/1800
2	7½	West.	SK-70	400/1600
1	7½	Al. Ch.		350/1050
1	7½	L-A	Baler	

110 Volt D.C. Motors

Qu.	H.P.	Make	Type	Speed
1	45	G.E.	RC	1100
1	20	G.E.	CD83	1750
1	20	G.E.	CD95	1150
2	10	Lincoln	I-8C	3500
1	10	E. Dyn.	3S	1100
1	10	West.	SK-70	1150
1	10	G.E.	CD73	1150
1	10	Reliance		400/1600
2	10	Diehl		230
1	7½	G.E.	CVC	725
1	7½	El. Dyn.	5S	450/900
1	7	El. Dyn.		600/1200

D.C. Generators

KW.	Make	Voltage	Ampere	Speed
300	Burke	250/125	1200	900
300	West.	250	1200	900
250	G.E.	125	2000	720
200	Cr. Wh.	550	363	900
100	G.E.	125	800	1150
100	Cr. Wh. (2)	125	800	1200
100	Al. Ch.	250/125	400	1150
75	Cr. Wh. (2)	125	600	1200
50	G.E. (2)	125	400	1150
50	G.E.	250	200	870
30	El. Dyn.	600	50	1150
30	G.E.	250	120	1750
30	G.E.	125	240	1150
25	G.E.	125	200	1150
20	West.	250	100	1150
10	West.	250	40	1150
10	West.	125	80	1150
7½	G.E.	250	30	1150
7½	West.	125	60	1150

AIR COMPRESSORS

12½"x12"	American
10"x6"	Gardner
9"x8"	Ingersoll Rand
9"x8"	Sullivan

300 K.W.
3 Wire, 250/125 Volt
Direct Current
Synchronous Motor Generator Set

Specifications:

Generator: 300 KW—Type CB67, 900 RPM, 1200 amperes, compound interpole, serial No. 136129.

Motor: Synchronous 450 H.P. —Type AC88, 3 phase, 60 cycle, 4150 volts, .85 P.F., serial No. 136011.

Equipment: D.C. Panel Board and Reduced Voltage A.C. Starting Panel.

Late Modern Equipment — Like New

THIS IS A PARTIAL LIST ONLY!

L. J. LAND & COMPANY

146 GRAND STREET, NEW YORK 13, NEW YORK

Established 1910

CAnal 6-6976

New England Representative
BOSTON, MASS., 411 Atlantic Ave.,
Phone: Liberty 4300

Branch:
READING, PENNA., 10th & Exeter Sts.
Phone: Reading 2-6866

When you buy Electrical Equipment- look to—

the judgement of experienced Electrical Engineers who KNOW Electrical Equipment

Hemphill rebuilding and testing is done under engineering supervision

MOTOR GENERATOR SETS

1—300 K.W. G. E. 275 V. 3 unit syn. motor 4150 V. 720 RPM.
1—150 K.W. Westinghouse 125 V. Sq. Cg. 220 V. 3 phase 900 RPM.
1—125 K.W. Crocker-Wheeler 125 V. Sq. Cg. 2300 V. 3 phase, 1200 RPM.
2—100 K.W. G. E. 230 V. A. C. Sq. Cg. 440 V. 3 phase, 60 cy. 1200 RPM.
1—80 KW. Crocker-Wheeler 3 unit 125 V. Syn. Motor, 220 V.
6—17 K.W. Allis-Chalmers 3 unit 120 V. Sq. Cg. 220 V. 1800 RPM.

ENGINE GENERATOR SETS

1—150 KVA. G.E. Ames Unaflow Engine, non-condensing.
1—120 K.W. Gasoline driven G.E. with Van Bierck Engine.

TURBO GENERATORS

1—600 KW. Terry dual bleeder condensing Turbine only
1—300 KW. 125/250 Volt General Electric non-condensing
1—300 KW. General Electric, 3 phase, 60 cycle, 220 volt cond.
1—30 KW. 135 volt, Allis-Chalmers, non-cond.

ALTERNATORS

1—500 KW. 3600 RPM. 600 volt, General Electric D.C. exciter
1—200 KVA. 3600 RPM. 240 volt, Allis-Chalmers D.C. exciter
1—180 KW. 514 RPM. 550 volt, Westinghouse
1—165 KW. 514 RPM. 2400 volt, Electric Mach.
1—62½ KW. 3600 RPM. 220 volt, Allis-Chalmers
1—40 KW. 1800 RPM. 550 volt, General Electric
1—35 KW. 1200 RPM. 240 volt, Columbia Electric D.C. exciter
1—31.3 KVA. 1200 RPM. 120/280 volt, American D.C. exciter
1—12.5 KVA. 1200 RPM. 240 volt, Westinghouse, D.C. exciter

TRANSFORMERS

1—1000 KVA. Auto Transf. 4150 V. 3 Ph. 4 wire to 2406 V. 2 Ph.
3—200 KVA. Pittsburgh 2200 volt 110/220
3—1000 KVA. Westinghouse 11430/250 volt
3—100 KVA. General Electric 13200/250 volt
3— 75 KVA. General Electric 13500/750/440 volt
2— 50 KVA. Pittsburgh 7500/15000 V. 110/220 v.

MOTORS—VARIABLE SPEED

230 VOLTS

2—200 H.P. 425/212 RPM. General Electric MPC
2—100 H.P. 950/1170 RPM. General Electric RC-37
1— 40 H.P. 700/1000 RPM. Sprague LC.
1— 30 H.P. 400/120 RPM. General Electric RC-204
1— 25 H.P. 650/2200 RPM. Westinghouse SK1110L
1— 25 H.P. 500/1500 RPM. General Electric RF-12
1— 25 H.P. 400/1200 RPM. Westinghouse SK
2— 25 H.P. 300/900 RPM. Electro Dynamic
1— 15 H.P. 300/1200 RPM. General Electric RLC-2024
1—13/18 H.P. 350/1200 RPM. Electro Dynamic
3—11½ H.P. 500/1500 RPM. Westinghouse
1—7½/10 H.P. 500/1500 RPM. Reliance
1—6/7.5 H.P. 450/1800 RPM. Crocker-Wheeler CMC
1—5 H.P. 500/1500 RPM Reliance
1—5 H.P. 600/1200 RPM. General Electric LC
1—5 H.P. 450/1800 RPM. Crocker-Wheeler CM
1—5 H.P. 400/1600 RPM. Diehl K6
1—5 H.P. 225/900 RPM. Electro-Dynamic

MOTORS 3 PHASE 60 CYCLE

SLIPRING

1—500 H.P. 900 RPM. Lincoln 440 volt
1—350 H.P. 203 RPM. General Electric MT-424 440 volt
1—225 H.P. 1800 RPM. General Electric I-L 220 volt
1—200 H.P. 600 RPM. Crocker-Wheeler S.R. 440 volt
1—200 H.P. 600 RPM. Westinghouse CW 220 volt
1— 75 H.P. 900 RPM. General Electric ITC 220 volt
1— 40 H.P. 1150 RPM. Cont Electric SA85 220 volt
1— 40 H.P. 1130 RPM. General Electric MT. 2200 volt

MOTORS 3 PHASE 60 CYCLE

SQUIRREL CAGE

1—400 H.P. 1200 RPM. Westinghouse 220 volt
1—200 H.P. 1200 G.E. 1K. 2200
2—100 H.P. 1200 RPM. General Electric, 220 volt, type KT and KF
1— 90 H.P. 380 RPM. Crocker-Wheeler 550 volt
1— 75 H.P. 690 RPM. Westinghouse 550 volt
2— 50 H.P. 900 RPM. Fairbanks-Morse H. 220 volt
2— 25 H.P. 1800/1200/900/600 U. S., 440 volt, 3 phase

D. C. GENERATORS

1—300 K.W. 250 V. G.E. MPC 1000 RPM
2—250 K.W. 250 V. Crocker-Wheeler Gen. 1200 RPM
1— 75 K.W. 250 V. Westinghouse 260 RPM
1— 50 K.W. 115 V. Westinghouse 1200 RPM
2—31.25 K.W. 125 V. Westinghouse 1400 RPM
2— 20 K.W. 50 V. G.E. 1800 RPM

MOTORS D.C. 230 VOLTS

2—450 H.P. General Electric MPL 250 volt 400 RPM
1—250 H.P. 750 RPM. Electro Dynamic 230 volt
1—125 H.P. 1725 RPM. General Electric RC-230 volt
1— 75 H.P. 575 RPM. General Electric C230 volt
2— 50 H.P. 700 RPM. Crocker-Wheeler CM 230 volt
2— 30 H.P. 1150 RPM. General Electric RC-31 230 volt
1— 30 H.P. 1100 RPM. General Electric RC-12 230 volt
1— 30 H.P. 750 RPM. General Electric RC-14 230 volt
1— 30 H.P. 625 RPM General Electric C 230 volt
1— 25 H.P. 600 RPM. Westinghouse SK 230 volt
1— 20 H.P. 800 RPM. General Electric RC-12 230 volt
1— 15 H.P. 350 RPM. Diehl G-312 230 volt

SYNCHRONOUS MOTORS

1—500 KVA. G.E. 900 RPM. ATI 4150 V. D.C. exciter
2—160 H.P. Elec. Mach. 1800 RPM. 2200 V DC. exciter
1—100 H.P. G.E. type TS, 600 RPM. 440 volt D.C. Exciter.
1—75 H.P. G.E. 1200 RPM. ATI 220 V. 3 phase
2—50 H.P. G.E. 1800 RPM. TS 220 V.
1—50 HP. G.E. 1800 RPM. ATI 20 V. D.C. exciter
1—35 KVA. G.E. 1200 RPM. ATI 2200 V. D.C. exciter
1—20 H.P. Westinghouse 1800 RPM. 220 V. .8 P.F.

FREQUENCY CHANGERS

1—7½ K.W. 15 KVA 50% P.F. 1800 RPM. 215 V. 270 Cy. C.W. Westinghouse
2—15 K.W. G.E. Type MM, 270 cy.

VERTICAL MOTORS

4—100 G.E. Vert. Hollow Shaft 1200 RPM. 220 S.C.
1— 75 G.E. Vert. Solid Shaft 1200 RPM. 220 S.R.
1— 60 Westinghouse Solid Shaft 900 RPM. 200 S.R.

MISCELLANEOUS

2—2100 Gallon Pumps Dayton-Dowd 100 foot head
4—12,000 GPM. 21' head Axial Flow Vertical Pumps with Motors

JLHCo

THIS SEAL IS YOUR GUARANTEE

"FOR POWER"

J. L. HEMPHILL & CO.

1604 53rd STREET, NORTH BERGEN, N. J.

PHONE NEW YORK—LONGACRE 5-3227

PHONE NEW JERSEY—UNION 3-2600

POWER PLANT MACHINERY

TURBINE UNITS
Condensing
3 Phase 60 Cycle

15630 KVA G.E.	6600 V. 185#
15300 KVA Wstgh.	13800 V. 200#
12500 KVA Wstgh.	2400 V. 200#
10715 KVA G.E.	2300 V. 200#
9375 KVA G.E.	2300 V. 180#
6250 KVA Wstgh.	4000 V. 175#
5000 KVA Wstgh.	2300 V. 160#
3750 KVA G.E.	480 V. 150#
3750 KVA Wstgh.	2300 V. 165#
3750 KVA G.E.	600 V. 175#
3125 KVA Wstgh.	2400 V. 175#
3125 KVA Wstgh.	600 V. 250#
2500 KVA G.E.	2300 V. 200#
2500 KVA G.E.	600 V. 155#
2500 KVA Wstgh.	2300 V. 200#
1875 KVA G.E.	200 V. 200#
1875 KVA G.E.	2300 V. 175#
1563 KVA Allis	2300 V. 210#
1563 KVA G.E.	600 V. 175#
1563 KVA G.E.	480 V. 175#
1560 KVA Wstgh.	2400 V. 175#
1250 KVA Allis	480 V. 150#
1250 KVA G.E.	2300 V. 175#
1250 KVA Wstgh.	2400 V. 240#
937 KVA G.E.	2300 V. 150#
750 KVA G.E.	2300 V. 150#
625 KVA G.E.	240 V. 200#
625 KVA G.E.	2300 V. 170#

TURBINE UNITS
Automatic Extraction
3 Phase 60 Cycle

3650 KVA Wstgh. 2300 V. 150#, 10# extraction

1875 KVA Wstgh. 240 V. 400#, 90# extraction

1250 KVA G.E. 2300 V. 150#, 10# extraction

1250 KVA Allis 480 V. 300#, 35# extraction

1250 KVA Allis 480 V. 150#, 12# extraction

780 KVA Wstgh. 2300 V. 185#, 15# extraction

750 KVA G.E. 600 V. 200#, 10# extraction.

625 KVA Wstgh. 480 V. 250#, 25# extraction

TURBINE UNITS
Noncondensing
3 Phase 60 Cycle

6250 KVA Allis 4600 V. 425#, 185# back pressure.

1875 KVA Wstgh. 240 V. 400#, 90# back pressure.

1250 KVA Allis 480 V. 150#, 5# back pressure.

625 KVA Allis 2300 V. 190#, 85# back pressure.

625 KVA G.E. 240 V. 200#, 50# back pressure.

625 KVA Allis 2300 V. 185#, 110# back pressure.

625 KVA G.E. 2300 V. 200#, 10# back pressure.

312 KVA C.W. Moore 240 V. 425#, 18# back pressure.

250 KVA Wstgh. 600 V. 150#, 15# back pressure.

250 KVA Wstgh. 480 V. 300#, 30# back pressure.

250 KVA G.E. 220 V. 240#, 5# back pressure.

TURBINE UNITS
Mixed Pressure
3 Phase 60 Cycle

2500 KVA G.E. 2300 V. 150# and 20# pressure

1250 KVA Wstgh. 4000 V. 150# and 2# pressure.

1250 KVA G.E. 2300 V. 125# and 2# pressure.

940 KVA Wstgh. 2300 V. 150# and 4# pressure.

COMPLETE POWER PLANTS
3 phase 60 cycle

3125 KVA Wstgh. turbine unit 600 volts, 250#, 200 deg. sup. with surface condenser and pulverized coal fired boiler.

1250 KVA (2) Wstgh. turbine units 2400 volts, 250#, 150 deg. sup. with surface condensers and two stoker coal fired boilers.

750 KVA (2) Skinner uniflow engine units, 2400 volts, 175#, O deg. sup. 15# B.P. with two stoker coal fired boilers.

UNIFLOW UNITS
3 phase 60 cycle

1000 KVA Skinner 2300 V. 115#
750 KVA (2) Skinner 2300 V. 175#
750 KVA Chuse 2300 V. 175#
560 KVA Skinner 480 V. 150#
500 KVA Chuse 2300 V. 150#
400 KVA (2) Skinner 240 V. 165#
375 KVA Skinner 480 V. 150#
350 KVA Ames 2300 150#
156 KVA (2) Skinner 240 V. 150#
150 KVA Ames 240 V. 150#

UNIFLOW UNITS
Direct Current

750 KW (2) Skinner 250 V. 160#
300 KW Skinner 250 V. 150#
200 KW Ames 125/250 V. 3-wire 150#
125 KW Skinner 115/230 V. 3-wire 125#

DIESEL UNITS
3 phase 60 cycle

625 KVA Gen. Mot. 2300 V. 720 RPM
375 KVA Worth. 2300 V. 277 RPM
375 KVA Chic. Pne. 2300 V. 257 RPM
312 KVA Bus. Sul. 2300 V. 225 RPM
300 KVA Fair. Mor. 2300 V. 257 RPM
250 KVA DeLaverqne 480 V. 277 RPM
250 KVA Gen. Mot. 440 V. 900 RPM
250 KVA Buckeye 240 V. 514 RPM
150 KVA Fair. Mor. 2300 V. 257 RPM
118 KVA Winton 240 V. 400 RPM
75 KVA Gen. Mot. 440 V. 1200 RPM

MOTOR GENERATORS
3 phase 60 cycle

300 KW G.E. Syn. 250 Volts D.C. 2300 volts A.C.
125 KW G.E. Syn. 125 volts D.C., 2300 volts A.C.

ROTARY CONVERTERS
3 phase 60 cycle

1500 KW Wstg. 250 D.C. 2300 A.C.
1000 KW Wstg. 250 D.C. 13200 A.C.
500 KW Wstg. 250 D.C. 2300 A.C.
150 KW Wstg. 250 D.C. 2300/4600 A.C.

SPECIAL OFFERING

2—375 KVA Two unit (156 KVA and 219 KVA) Electric Machinery alternating current generators, 3 phase 60 cycle 240 volts 360 RPM direct connected to Skinner Vertical Universal Uniflow engines, two cylinders' 140-165# steam pressure 0-7# back pressure.

Used only two winters — Excellent condition

INTERNATIONAL POWER MACHINERY CO.

UNION COMMERCE BLDG. **Telephone: MAin 9514** **CLEVELAND 14, OHIO**

TWO BULLSEYES!

WE OWN WHAT WE ADVERTISE

BELYEA

SUCCESSFUL OPERATION GUARANTEED

WE buy it before you buy it—SO IT HAS TO BE GOOD—and you GET IT QUICKER!

RE-NU-BILT BELYEA MOTORS

Because it's RE-NU-BILT by specialist in Electrical Power Equipment!

"SUCCESSFUL OPERATION GUARANTEED"

MOTOR GENERATOR SETS

3 Phase—60 Cycle

1—1500 KW G.E. 275 V. D.C. to 2100 H.P. 4400/2200 V. Syn. with exciter.
1—400—3 unit with 2—200 KW—GE DC gens. and 700 HP, 2300 v.
1—300 KW—Cr. Wh. 3 unit with 150 KW. 125 v. D.C. gens. and 450 HP—4150 v. Syn.
1—200 KW GE 250 v. DC to 300 HP 440 v. Ind.
1—150 KW—Whse. 600 V. D.C. to 200 HP—2200 V.
1—150 KW Whse. 3 unit (2) 75 KW 125 B. Gen. D.C. to 200 HP—2300 V. Ind.
1—85 KW. GE—250 V. DC to 150 HP—440 V. Ind. Motor.
1—75 KW GE 250 V. DC to 125 HP—220 V. Ind.
1—75 KW GE 125 V. D.C. to 120 HP—2300/4000 V. Ind.
1—50 KW GE 125 V. D.C. to 75 HP—2300/4000 V. Ind.
2—48 KW 3 unit with 2—24 KW GE 60 volt D.C. gens. and 60 HP—440 v. Sq. Cg.

SPECIAL

1—500 KW—GE 250 V D C to 700 HP—2300/4150 Syn. Motor — 3 phase — 25 cycle with Controls.

TRANSFORMERS—60 Cycle

Qu.	Kva.	Make	Ph.	Type	Voltages
1	1050	G.E.	3	WCTH	11000x445/222½
4	525	G.E.	1	HJ	2300x445
2	333	Pitts.	1	OISC	2400x220
1	300	Pitts.	3	OISC	4150x208/120
3	200	G.E.	1	HJ	2300x408/204
1	200	G.E.	2-3	Auto	2500x2500
3	100	G.E.	1	HJDD	13200x445/226
3	100	Whse.	1	OISC	13200x250

A. C. GENERATORS

3 Phase—60 Cycle

Qua.	Kva.	Make	Type	R.P.M.	Volts
1	37.5	G.E.	ATI	1200	220/127
1	45	Whse.		514	2300
1	125	G.E.	ATI	900	2300
1	337	Whse.		360	480

A. C. MOTORS

3 Phase—60 Cycle

SLIP RING

Qu.	H.P.	Make	Volts	R.P.M.	Desc.
1	2500	G.E.	6600	253	MT
1	800	Al. Ch.	440	885	ANY
1	600	Cr. Wh.	2200	507	131 AQ
1	600	Whse.	440	400	CW
1	600	G.E.	2200	600	MT
1	350	G.E.	4000/2300	253	MT-442Y
1	250	G.E.	4000	257	MT-424Y
1	225	G.E.	550	720	IM-17
1	60	G.E.	2200	1755	MT-337

SQUIRREL CAGE

1	725	G.E.	13800/2300	600	KT
1	400	G.E.	2200	1175	IE-183
1	300	G.E.	2200	600	IK
1	300	G.E.	440	900	IK
1	250	G.E.	440	600	IK
1	200	G.E.	550	580	IK
1	200	G.E.	2300	1175	IK
1	200	G.E.	440	580	IK
1	200	Al. Ch.	2300	1175	
2	175/112	G.E.	440	900/720	IK
1	150	G.E.	440	1200	K-6325B. Brg
2	150	G.E.	440	600	IK
1	100	L. A.	440	1760	EK
1	100	G.E.	440	900	IK
1	100	G.E.	2300	450	IKVert.

SYNCHRONOUS

2	2100	G.E.	2200/4400	514	ATI
1	600	G.E.	2300	900	TS
1	125	G.E.	2300	900	ATI

SYNCHRONOUS CONDENSER

1	5000	Whse.	2300/4000	900

ROTARY CONVERTERS

3 PHASE—60 CYCLE

Qu.	Kw.	Make	Speed	D.C.V.	Trans. V.
1	1500	Whse.	720	600	2300
1	1500	Whse.	600	600	11500
1	1250	G.E.	720	250	2300
1	1000	Whse.	900	600	11000
1	750	Whse.	720	250	6600/2300
1	500	Whse.	1200	600	13200/2300

3 PHASE—25 CYCLE—BOOSTER TYPE

2	1500	G.E.	500	225/275	13200/6600

All units can be furnished with A. C. & D. C. control.

SPECIAL

1—2000 amp., 3 pole, 15000 V Conduit types F-120-15 D, 230 V Sol. operated OCB—1000 000 uninterrupting capacity.

D. C. MOTORS

Qu.	H.P.	Make	Type	Volts	Speed
4	800/1000	Whse.		450	600/750
1	800	G.E.	MPC	550	600
1	700	G.E.	MCF	600	150/525
1	650	G.E.	MPC	250	115/145
1	325	Whse.		230	1050/1250
2	350	G.E.	MPC	230	450
1	300	G.E.	MPC	230	275/550
1	300	G.E.	DMC	230	400/600
2	300	Cr. Wh.	CCM-151H	230	630/700
1	250	G.E.	MPC	230	400/500
1	250	Al. Ch.		230	525
1	150	G.E.	MPC	230	250/450
1	130	Cr. Wh.	CMC-65H	550	1200
2	125	G.E.	CO-1832	230	625
2	100	G.E.	TLC	250	1050/3500
1	75	Cr. Wh.	100HL	230	350/900
1	75	G.E.	C	230	650/900

TURBO GENERATOR SETS

1—500 KW—Whse. 625 KVA. 440 v. 3 ph. 60 cy. 3600 RPM with Parsons 145/175 lbs. condensing turbine with jet condenser and accessories.
1—75 KW Ridgeway 250 V. D.C. with Terry 180 lb. with 12 lb. back pressure, 2000 RPM.

38TH YEAR OF SERVICE

WE OWN WHAT WE ADVERTISE IT HAS TO BE GOOD!

BELYEA COMPANY, INC.

We Buy for Stock — for CASH
What Surplus Do You Have?

PHONE—JOURNAL SQUARE—2-3334
Also
N. Y. CITY — RECTOR 2-7150

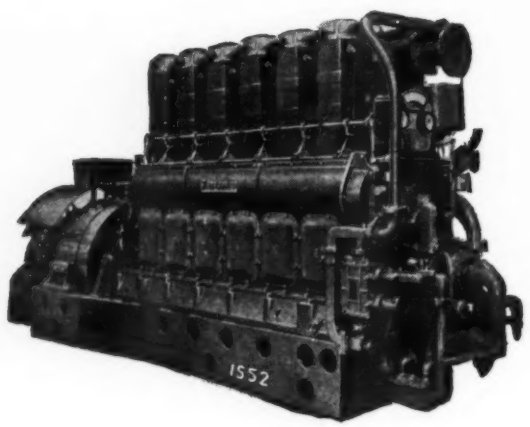
Main Office and Shop

43 HOWELL STREET

JERSEY CITY 6, N. J.

DIESEL GENERATORS

DIRECT CURRENT



4—250 KW Diesel Generators, 3-Direct-Current 120/240 volt, 3-wire

Each direct connected to

4—450 HP Enterprise, diesel engines, Type DSG-8, 450 RPM, 6 cylinder, 12" bore x 16" stroke

COMPLETE EQUIPMENT

BRAND NEW

OTHER DIRECT CURRENT OFFERINGS—IMMEDIATE DELIVERY

KW	VOLTS	MAKE	HP	MODEL	RPM	YEAR
3—500	120/240	General Motors	750	8-278-A	720	New
2—300	120/240	General Motors	450	6-278-A	750	New
6—275	120	Cooper Bessemer	440	FS-8	800	New
2—250	120/240	Enterprise	450	DSG-8	450	New
3—100	120/240	Superior	150	GDB-8	1200	New
1— 90	120	Winton	140	144	1200	1939
2— 60	120	General Motors	90	6-71	1200	1943
3— 15	120	Hill	30	4 C	1200	1940
2— 12	120	Hill	25	4 R	1200	1939
2— 10	120	Hill	20	4 R	1200	1940

WRITE — WIRE — PHONE

80,000 DIESEL HORSEPOWER FOR IMMEDIATE SHIPMENT

A. G. SCHOONMAKER COMPANY

DIESEL ENGINES
POWER CONSTRUCTION EQUIPMENT

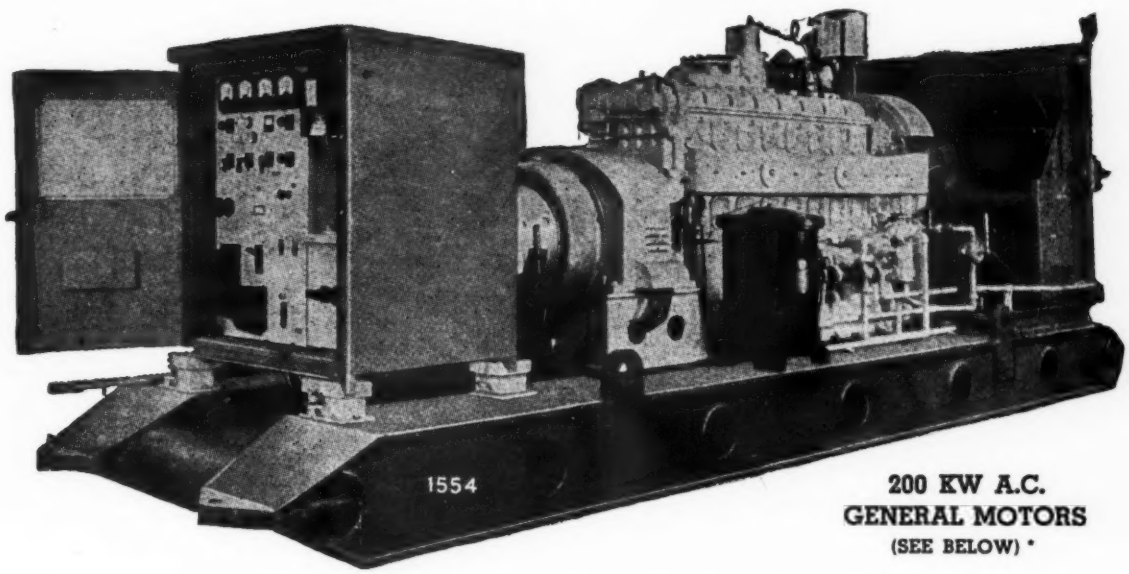
50 CHURCH ST., N. Y. 7, N. Y. *Established 1898*

Phone WOrth 2-0455
Cable Address Agscomach.

DIESEL GENERATORS

ALTERNATING CURRENT

50 AND 60 CYCLES



200 KW A.C.
GENERAL MOTORS
(SEE BELOW) *

OTHER IMPORTANT OFFERINGS FOR QUICK DELIVERY ! !

KW	MAKE	H.P.	MODEL	RPM	YEAR
2—1500	Fairbanks Morse	2000	33E16	300	1939
1—1000	Nelseco	1500	6M1-53	300	1931
3—1000	General Motors	1600	16-287-A	720	1944
2— 800	General Motors	1200	16-278-A	600	1944
1— 500	Superior	750	OS	327	1938
1— 300	General Motors	450	6-278-A	600	New
2— 250	Enterprise	450	DSG-6	450	1945
1— 240	Fairbanks Morse	360	YVA	257	1928
*3— 200	General Motors	300	8-268-A	900	New
6— 200	General Motors	400	8-268-A	1200	1945
1— 125	Buckeye	190	70	514	1941
5— 100	General Motors	200	3-268-A	1200	1944
1— 75	Buckeye	112	E	400	1936
8— 60	General Motors	90	6061E	1200	New
15— 50	International	75	UD18	1200	New
8— 30	International	45	UD14	1200	New

80,000 DIESEL HORSEPOWER FOR IMMEDIATE SHIPMENT

WRITE FOR BULLETINS

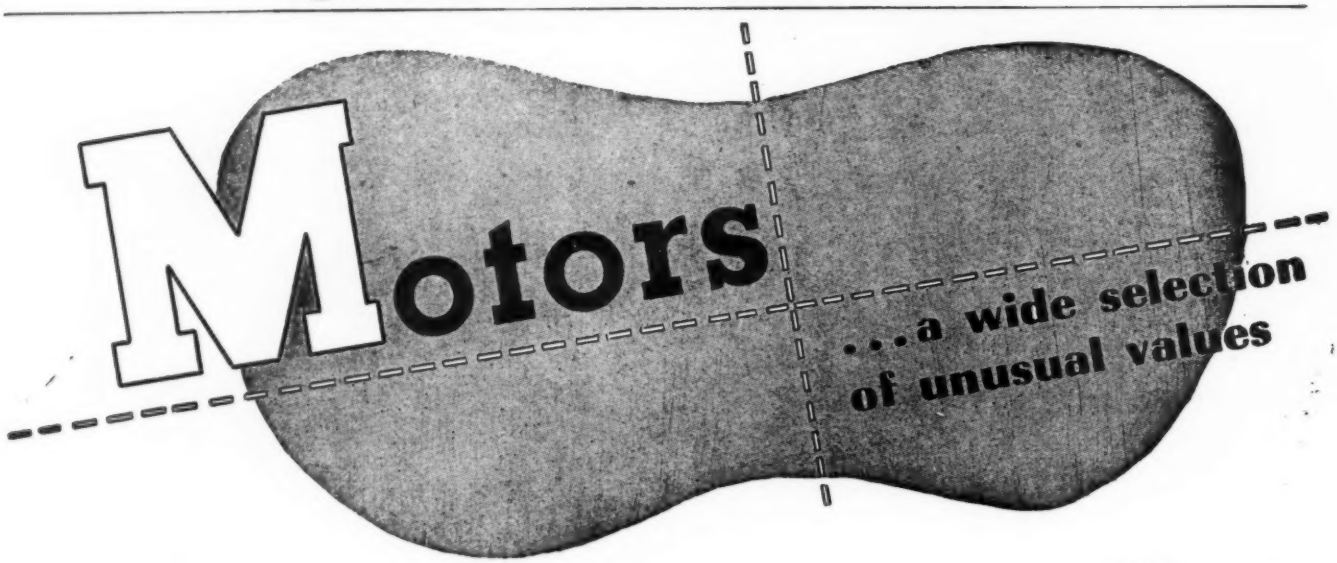
A. G. SCHOONMAKER COMPANY

DIESEL ENGINES
POWER CONSTRUCTION EQUIPMENT

Business Est. 1898

50 CHURCH ST., N. Y. 7, N. Y.

Phone WOrth 2-0455
Cable Adress Agscomach.



Listed below a few of the motors available in a hurry from Wente

SQUIRREL CAGE

3 Phase, 60 Cycle, 220/440 Volt,

Qu.	HP	Make	Type	Speed
5	200	G.E. 2300v.	FT527	3600
1	150	Al. Ch.		1750
2	125	L. A. 2300v.	Ball Bearing	3600
1	100	R'way 440v.		1200
1	100	West. 2200v.	CCL	1720
1	100	G.E.	I	340
1	100	G.E.	I	290
1	75	Lincoln	IQ	600
1	75	G.E.	KT562	450
6	75	G.E. 440v. new Ball Bearing	K	1800
1	50	G.E.	I	720
2	50	West.	MS 25 cy.	720
1	50	Wag.	BM	495
1	50	Al. Ch.		490
2	50	Al. Ch.		860
1	50	West.	CS	870
1	40	Al. Ch. 2200v.		1160
1	40	Triumph	B12	850
2	35	Al. Ch.	2 ph.	865
2	35	Al. Ch.		865
1	35	Ft. Wayne	2 ph.	900
1	35	G.E.	25 cy.	730
1	30	F.M. 2200v.	HD12B	3600
1	30	Al. Ch.		1200
1	20	Louis A.	KH	1170
1	30	West.	CCL	900
1	30	Wagner	22VBR	860
2	30	Al. Ch.	AN 2 ph.	860
1	30	Century	AS 25 cy.	720
2	30	West. new B.B. 440v.		1750
2	25	West. new B.B. 440v.		1160
2	25	G.E. B.B. 440v.		1160
1	25	R. & M.	K207	1750
1	25	Howell		1200
1	25	Lincoln		900
1	25	G.E.	KT332	900
1	25	Al. Ch.		860
1	25	Rel. (elevator) T.E.		750
1	25	Al. Ch.		720
1	25	G.E.	M10	720
1	25	West.	CS644C	690
1	25	Al. Ch.		1150
2	25	Al. Ch.		850
1	20	Al. Ch.		1160
1	20	Al. Ch.		860
1	20	Al. Ch.		1700
1	20	Century		1740
1	20	F. M.	KRV	1200
1	20	West.		1200
1	20	Ideal	A	1150
1	20	Cleve.	M-147	960
1	20	Al. Ch.		860
1	20	R. & M.	K-207	900
1	20	West.	CS-644	870
1	20	West.	MS	900
1	20	F. M.	H	870
1	20	West.	CCL	580
1	20	Wagner	CM	445
1	18	West.	MS-4(Elev.)	720
1	15	West.	CCL	1700
1	15	Cr. Wh.	115Q	1720
1	15	Wagner	15TCP-TEFC	1140
2	15	West.	CS-573 25 cy.	725
2	15	West.	MS 25 cy.	725
1	15	West	CS567C 25 cy.	715
1	15	West.	MS 25 cy.	600
1	10	West.	CS 25 cy.	725
1	10	West.	MS 25 cy.	720
2	10	West.	CS473C 25 cy.	615
1	7½	Wagner	MCP-365	1140
1	7½	Lima	RS-405 b.b.	514

SLIP RING

3 Phase, 60 Cycle, & Syn.

Qu.	HP	Make	Type	Speed
1	443	El. Mach.		900 Syn.
1	200	F.M.	BV	600
1	200	Westg. 2200v.		600 Syn.
2	75	F.M. 2200v.	BV-H16B	1800
1	75	G.E.	MT552	865
1	50	Triumph	C12	1150
1	50	Ideal 2200v.	AV	575
1	50	G.E.	IM 25 cy.	700
1	50	Al. Ch.		690
2	40	G.E.	MT336	1200
1	40	Al. Ch.		1160
1	40	W'g 2200v.	CW	870
1	40	Westg.	CW-658-A	870
2	40	Al. Ch.		870
1	40	Westg.	C1753A 25 cy. cr.	730
10	35/15	G.E.	OMT336	1150/550
1	35	Al. Ch.	25 cy.	720
2	35	G.E.	IM	570
1	30	F. M.	AD Alt.	1200
1	20	Imperial	DW-D37	1800 Syn.
1	22	G.E.	ITC5011 (hoist)	680
1	25	Westg.	MW 322A	680
1	25	G.E.	MT342	600
1	25	G.E.	MT356	400
1	20	Triumph	C10	1200
2	15	G.E.	MT302	1200
1	15	G.E.	MT332	720
1	15	Westg.	CS	585
1	15	G.E.	MT556	280
3	10	Westg.	CW464A	1200
1	10	Westg.	HF	1140
1	7½	G.E.	MT182	1750
8	2	G.E.	MT926 slip ring	1800

DC—230 Volt

Qu.	HP	Make	Type	Speed
1	75	Diehl	K11	700
1	100	G.E.	CD123	1200
1	60	Westg. 115v.	SK140L Vert.	1140
1	60	G.E.	EFI	1200
1	40	Rel. 440v.	13LT Vert.	1750
1	40	Rel. 440v.	230T Vert.	1130
1	25	C.W. 440v.	CMC-EH Vert.	1150
2	40	Westg.	SK 123	1150
3	40	G.E.	RC32	1100
8	40	Westg.	SK 140	775
1	35	R. C.	11B	1500
1	35	Al. Ch.		1200
1	35	G.E.	DLC 203	700
1	35	Westg.	SK 163 Vert.	300/1200
1	30	El. Dy.	15S	625
1	30	Westg.	SK 110L	1150
1	30	Rel. 440v.	131 T Vert.	1150
4	30	Reliance	92 TF	1750
1	27½	G.E.	CVC 116	1750
10	25	Westg.	SK 120	825
3	25	Westg.	SK 103	1150
1	25	Westg.	SK 90	1400
4	25	Westg.	SK 100 L	1150
1	30	G.E.	RC 51B	1150
1	25	Westg.	SK 123	550/1100
1	25	Al. Ch.	E 120	500/1500
1	25	G.E.	RF 12	400/1200
2	25	Westg.	SK	400/1200
1	25	J. & L.		625
2	20	Reliance	131T	1000
2	20	Diehl	K914A	500/1500
2	20	Westg.	SK113	500/1500
1	20	G.E.	RF12	250/1000
1	20	Lincoln	FKW B.B.	1800
1	20	Westg.	SK70L	1700
6	20	Cr. Wh.	CMC T.E.B.B.	1750
1	20	Cr. Wh.	CMC T.E.B.B.	1150
1	20	Westg.	SK93	1150
14	20	Reliance	92T	1150
1	20	Westg.	SK 120 T.E.	1100
3	20	Westg.	SK 100L	900
1	20	Watson	K	850
3	20	Reliance	131T	850
1	20	G.E.	RC30	750
1	20	Westg.	SK110L-115V	750

DC—230 Volt

Qu.	HP	Make	Type	Speed
4	20	Westg.	SK110L	750
1	20	Cr. Wh.	CW-CMC	600
1	20	Westg.	SK120	500
3	20	Al. Ch.	K	500/100
1	15	Reliance	46TF	1750
2	15	Westg.	SK63	1750
1	15	Westg.	SK113 encl.	1750
1	15	G.E.	RC29A	1700
1	15	Westg.	SK93	1150
4	15	Westg.	SK83	1150
4	15	Cr. Wh.	CW-CCM T.E.	1150
1	15	Westg.	SK70L	1250
1	15	G.E.	CD83	1150
1	15	G.E.	RC10	1150
1	15	G.E.	RC29	1150
4	15	Westg.	SK93	850
4	15	Reliance	92TF	850
4	15	R. & M.		1000
1	15	G.E.	CVC-115	925
6	15	Westg.	SK90 Vert.	825
1	15	G.E.	RC29	750
6	15	Westg.	SK110L	675
1	15	Al. Ch.		1075
8	15	Reliance.	131T	550
3	15	Reliance	92T	850/1750
3	15	Reliance	92T	850/1700
1	15	Reliance	66T	800/1600
1	15	Westg.	SK	500/1500
2	15	Westg.	SK110L	400/1600
1	15	Triumph	32F	300/600
1	15	Triumph		225/900
1	12½	Westg.	SK	750/1500
7	10	Westg.	SK70	850
2	10	G.E.	RC29	850
2	10	Reliance	66TF	850
20	10	Westg.	SK60L-SK60-Reliance 46TF	1150
10	10	Cr. Wh.	CM CHB T.E.B.B.	1750
4	10	Westg.	SK-43	1700
1	10	G.E.	RF11	600/2400
4	10	G.E.	RF10	600/1800
6	10	Westg.	SK80L	500/1500

DC—230 Volt

Qu.	H.P.	Make	Type	R.P.M
23	10	Al. Ch.		500/1000
1	10	G.E.	RF10	400/1200
2	10	Kimble	BA324 new B.B.	1750
1	10	Westg.	SK91	250/1000
21	7½	Westg.	SK33	1750
16	7½	Westg.	SK43	1150
20	7½	Westg.	SK60	850
20	5	Westg. & G.E.		1750
60	5	Westg. Rel.		1150
50	5	Westg.	SK43	580
75	3½	Westg.	SK33	850
80	3	Westg.	CD925	1725
120	3	Westg.	SK20	1550
60	2	Westg.	SK & CD	1150
50	2	Westg.	SK20	850
40	1½	Westg.	CD	1150
30	1½	Westg.	CD925	550/2200

1—New 40/50 HP Westinghouse, type SK, frame 141, 230 Volt, DC, 300/1200 RPM, ball bearing

1—150 KW new, ball bearing, 440/250 Volt DC, 1200 Westinghouse M-G sets

1—150 KW new, 440/250 Volt DC General Electric M-G set

The Wente Electric Co.

Hamilton, Ohio

Rebuilt Motors & Generators

Since 1906

FOR SALE—IMMEDIATE DELIVERY

POWER PLANT EQUIPMENT

TURBINE-GENERATOR UNITS

3 Phase, 60 Cycle

6250 KVA Allis non-condensing, 450 lbs. pressure, 725° TT, 185 lbs. exhaust 4500 volts, 3600 RPM.

3750 KVA G.E. condensing, 200 lbs. pressure, 500° TT, 2,300 volts, 3600 RPM complete with surface condenser and switchboard.

2500 KVA G.E. condensing, 150 to 200 lbs. pressure, 2300 or 550 volts, 1800 RPM complete surface condenser, exciter and panel.

2500 KVA Westinghouse condensing, 180 lbs. pressure, 2300 volts, 3600 RPM, complete surface condenser, exciter, switchboard.

1875 KVA Westinghouse condensing, 175 to 200 lbs. pressure, 500° TT, 480 volts, 3600 RPM, compete with turbine driven exciter set, switchboard, Westinghouse jet condenser and condensing auxiliaries.

1250 KVA Westinghouse non-condensing, 200 to 250 lbs. pressure, 500° TT, 15 lbs. gauge back pressure, 480 volts, 3600 RPM, complete with exciter, switchboard panel.

1250 KVA Westinghouse condensing, 2400 volts, 3600 RPM, 200 lbs. pressure, equipped with direct connected shaft exciter, condenser, switchboard and instruments.

938 KVA Allis Automatic Extraction condensing, 250 to 300 lbs. pressure, 500° TT, 2300 volts, 3600 RPM, complete surface condenser, exciter and switchboard.

375 KVA G.E. condensing, 150 to 200 lbs. pressure, 100° SH, 2300 volts, 3600 RPM, complete with surface condenser and auxiliaries.

250 KVA G.E. non-condensing, 240 lbs. pressure, 5 lbs. gauge back, 220 volts, complete with exciter and switchboard.

125 KVA Westinghouse non-condensing, 175 to 200 lbs. pressure, 0-10 lbs. gauge back, 240 volts with direct connected exciter and switchboard.

125 KVA G.E. non-condensing, 175 to 200 lbs. pressure, 10 lbs. gague back, 2300 volts, 3600 RPM complete with switchboard.

100 KVA Westinghouse non-condensing, 125 to 150 lbs. pressure, 10 lbs. gauge back, 2400/600 volts, 3600 RPM complete.

ENGINE-GENERATOR UNITS

3 Phase, 60 Cycle

Alternating Current

575 KVA General Electric, 460 volts, 150 RPM generator direct connected to 24" x 36" Nordberg Unaflow engine, 150 to 175 lbs. pressure, 10 to 40# back pressure.

500 KVA Westinghouse, 460 volts, 164 RPM generator direct connected to 26" x 28" Skinner Unaflow non-condensing engine, 140 to 160 lbs. pressure, 0 to 10-lbs. gauge back pressure. Complete installation.

500 KVA G. E. 2300 volt generator direct connected to Chuse Unaflow non-condensing engine.

312 KVA Elliott, 4000/2300/550 or 240 volts, 180 RPM generator, direct connected to a 17" x 24" Elliott Unaflow non-condensing engine, 175 lbs. pressure, 6 lbs. back pressure.

300 KVA G. E. 2300/480/240 volts, 200 RPM generator direct connected to Skinner Unaflow non-condensing engine—Complete.

225 KVA E. M. 2300 volts, 200 RPM generator direct connected 19" x 24" Chuse Unaflow poppet valve engine.

200 KVA Crocker-Wheeler, 240 volts, 400 RPM generator direct connected to Ames vertical Unaflow engine, 110 to 125 lbs. pressure, 5 lbs. gauge back pressure.

150 KVA G.E. 240 volts, 225 RPM generator direct connected to Ames Unaflow engine.

75 KVA Allis 2300/550 or 440 volt, 257 RPM generator direct connected to 12" x 16" Chuse 4 valve non-releasing Corliss engine.

ENGINE-GENERATOR UNITS

Direct Current

300 KW Allis-Chalmers, 250 volts, 150 RPM generator direct connected to 24" x 28" Chuse Unaflow non-condensing engine, 130 to 150 lbs.

125 KW, 125 volts, 250 RPM generator direct connected to 18" x 16" Elliott engine, 100 lbs. pressure, 10 lbs. back pressure, complete with switchboard.

75 KW Westinghouse, 125 volt, 1800 RPM non-condensing turbine generator unit.

75 KW Allis-Chalmers Terry, 125 volts, 2400 RPM non-condensing turbine-generator unit.

15 KW (2) Crocker-Wheeler, 125 volts, 410 RPM generators each direct connected to an American Blower vertical engine.

SPECIAL OFFERINGS

125 KVA (4), 3 phase, 60 cycle, 480 volts, 514 RPM Electric Machinery horizontal synchronous generators. NEW.

500 KVA Westinghouse, 3 phase, 60 cycle, 600 volts, 514 RPM belted generator.

750 KVA Westinghouse, 3 phase, 60 cycle, 2300 volts alternating current generator, direct connected to 910 HP, 3 phase, 25 cycle, 2300 volts, 300 RPM synchronous motor.

1000 KW, 265 volt direct current—6 phase, 60 cycle, 514 RPM Westinghouse booster type rotary converter complete with transformers.

1200 KVA General Electric, 3 phase, 60 cycle, 2400 volts alternating current generator direct connected to 1700 HP, 3 phase, 25 cycle, 2300 volts, 300 RPM synchronous motor.

3480 sq. ft. Allis surface condenser.

6000 sq. ft. C. H., Wheeler surface condenser.

10 Ton Brown Hoist hand-operated crane with 31' 0" span, approximately 150 ft. 15" I-beam with 6" wide flange.

2—10 Ton Yale Spur Geared Chain Blocks.

1—ALLIS-CHALMERS SYNCHRONOUS MOTOR GENERATOR SET CONSISTING OF: 1500 KW 550/600 volts, 300 RPM compound wound interpole direct current generator direct connected to a 2190 HP, 3 phase, 60 cycle, 4000 volt, 300 RPM, A.C. motor.

Utilities Electrical Machinery Corporation

600 NATIONAL CITY BANK BLDG
CLEVELAND 14, OHIO

WIRE OR PHONE
LONG DISTANCE 422

THREE AIR COMPRESSORS

Available For Immediate Shipment

1—1856 CFM. 100# pressure, 23x13x14 Chicago Pneumatic, Class OCE, 2 stage Air Compressor, direct driven by 300 HP 3 ph. 60 cyc. 2300 v. 277 RPM Synchronous Motor, complete with 5 stage automatic starter and MG Set Exciter, after cooler, air filter, 54" x 14' air receiver. *New in 1944—used 10 months*

1—Schramm gas driven air compressor. Displacement 315 CFM, at a working pressure of 100#. Portable mounted on pneumatic tires with a spare set of steel wheels complete and self-contained.

1—Schramm gas driven air compressor. Displacement 210 CFM, at a working pressure of 100#. Portable mounted on pneumatic tires with a spare set of steel wheels complete and self-contained. *Purchased in 1945.*

TURBO-GENERATORS – MOTORS – WELDERS

1—5000 KW Westinghouse Turbo-Generator, 3600 RPM, 200# pressure, condensing, 2300/3/60 complete

1—710 HP Terry Turbine, 3600 RPM, 145# ISP, 0-60# BP, 18" x 18" centrifugal pump, rated 13,000 GPM, 170' head, 1000 RPM

1—KW Westinghouse Turbo-Generator, 200# pressure, 75 HP, 7200 RPM, geared to 50 KW, 125 V DC 1200

1—800 KW Westinghouse M-G set, Synchronous Motor, 1150 HP, 514 RPM, 13200/60/3. Generator 250 V DC with direct connected exciter

1—300 KVA Generator Set, Burke Alternator, 480/60/3, 200 RPM, direct connected to exciter and Skinner Uniflow, 150# ISP, 0-5# BP

1—1000 H.P. General Electric Slip Ring Motor, 6600/60/3, 600 RPM, with controls

1—700 H.P. General Electric, Type KF motor, 2300/60/3 1800 RPM

1—150 KW General Electric Alternator, Type ATB, Form B, .8 PF, 480/60/3 600 RPM, 3 bearing, direct connected exciter

300 and 400 Ampere

MOTOR DRIVEN ARC WELDERS

General Electric—Hobart—Lincoln
New 1943 — Reconditioned
Used less than 1 yr.

also

300 AMPERE GASOLINE WELDERS

Hobart — Duarc — P&H — STAR

CARRIER AIR CONDITIONING UNIT

1—25-ton Carrier Air-Conditioning Unit, Complete including Kathabar unit. Installed new in 1944. Used one season

MISCELLANEOUS

1—3600 sq. ft. Wheeler Surface Condenser

2—12" LeCourtney Centrifugal bronze fitted pumps, 1800 RPM

1—20-ton Box Crane, hand operated, 39 ft. span, complete ½, ¾, 1, 1½ and 2 ton Chain Hoists, standard Lift ½, 1 and 1½ ton Electric Hoists, 3 ph. 60 cyc. 220/440 volt

25 ton Carrier Air Conditioning Unit, complete with Kathabar Unit, used four months

35 KVA Gasoline Driven Power Plant, 3 ph., 60 cyc., 220 volt

Heat and Power Co., inc.

70 PINE STREET · WHITEHALL 3-2172 · NEW YORK 5, N. Y.

BERGER OFFERS

Rebuilt and Sold with a Standard New Guarantee

IND. FREQUENCY CHANGERS SETS
ALL SIZES, VOLTAGE AND CYCLES

MOTOR GENERATOR SETS
ALTERNATORS ALL FREQUENCIES
TRANSFORMERS LARGE STOCK
D. C. GENERATORS ALL VOLTAGES
CONTROL EQUIPMENT

3 ph. 60 cy. A. C. Motors
3 ph. 25 cy. Motors
125 Volt D. C. Motors
230 Volt D. C. Motors
550 Volt D. C. Motors

WRITE OR WIRE YOUR INQUIRIES

BERGER BROTHERS Electric Motors, Inc., 395 STATE ST., ROCHESTER 4, NEW YORK
PUT ALL IDLE EQUIPMENT TO WORK. SEND YOUR LIST FOR PROMPT ACTION.

LARGE QUANTITY

COPPER and LEAD CABLE

DEGAUSSING

FOR SALE

IMMEDIATE SHIPMENT

7 Conductor	7 Strand	.044
7 Conductor	19 Strand	.052
7 Conductor	7 Strand	.064
7 Conductor	19 Strand	.064
7 Conductor	19 Strand	.044

STEEL ARMORED LEAD COVERED CABLE
BRAID COVERED LEAD CABLE
BRAID COVERED COPPER CABLE

ATTRACTIVELY PRICED FOR QUICK SALE

HARRY HARRIS & CO.

KEARNY, N. J.

N. Y. Phone REctor 2-0411 N. J. Phone Kearny 2-6240

FOR SALE

TURBINE GENERATOR SET

780 KVA Westinghouse Generator, 2300 Volts, 3 Phase, 60 Cycle, 3600 RPM with Air-cooling unit. Complete with all instruments. Direct connected to Westinghouse Turbine. 700 Sq. Ft. surface condenser and pumps for handling condensate and cooling water.

GLAZER STEEL CORPORATION
2100 Ailor Avenue Knoxville, Tenn.
Phone 3-0738

WURTH for "WORTH"!

A.C. GENERATORS 3 PHASE—1 PHASE 15 TO 62½ KVA

LARGEST STOCK OF A.C. AND D.C. MOTORS FROM 5 TO 200 H.P.
D.C. MOTOR GENERATOR SETS TO 75 KW • HIGH CYCLE GENERATORS
Send For Our Latest Stock List

WURTH ELECTRIC MOTOR COMPANY
Motors, Generators, Alternators, Frequency Changers.
141 GRAND ST. — CAnal 6-6138 — NEW YORK CITY

FOR SALE

BOILERS

16—394 H.P. B & W water tube boilers ASME Code, 160# pressure, oil fired. Immediately available.

HUDSON IRON & METAL CO.
Foot E. 33rd St. Bayonne, N. J.
Phone—Bayonne 3-1811

NEW and USED EQUIPMENT AVAILABLE
for
Power Plants, Sub-Stations, Transmission Lines and Construction
Send for new list to
APPARATUS EXCHANGE
EBASCO SERVICES INCORPORATED, TWO RECTOR ST., NEW YORK 6, N. Y.

FOR SALE

BOILER—BURNER—PUMP

1—ALMY Type HA Water Tube Test Boiler 600# Operating Pressure, complete with #0 Gravity Type Ray Oil Burner and 6x2x6 Warren Horizontal Duplex Piston Steam Pump.

No reasonable offer rejected.

ADDRESS
BATH IRON WORKS CORP.
BATH, MAINE

THE PICK OF POWER EQUIPMENT

TURBINE UNITS—60 Cy.

1—22500 KW General Electric Cond.
1—15300 KVA Westinghouse Cond.
2—12500 KW General Electric Cond.
1— 6250 KVA Allis Chalmers Topping
1— 5000 KVA General Electric Cond.
1— 3750 KVA Westinghouse Extrac.
1— 3125 KVA Westinghouse Cond.
1— 2500 KVA General Electric Cond.
1— 1875 KVA Westinghouse Cond.
1— 1875 KVA Westinghouse Non-C.
1— 1563 KVA Westinghouse Extrac.
2— 1250 KVA General Electric Cond.
1— 1250 KVA General Electric Extrac.
1— 375 KVA General Electric Cond.

D. C. TURBO UNITS

1—250 KW Westinghouse, 120/240 V.
1—125 KW General Electric, 125 V.
1— 75 KW General Electric, 125 V.
1— 50 KW Westinghouse, 125 V.

STEAM ENGINE UNITS—60 Cy.

1—900 KW Hamilton Uniflow
1—625 KVA Ames Uniflow
1—500 KVA Chuse Uniflow
2—480 KVA Skinner Uniflow
1—375 KVA Harrisburg Uniflow
1—325 KVA Skinner Uniflow
1—300 KVA Skinner Uniflow
1—150 KVA Ames Uniflow

D. C. STEAM ENGINE UNITS

1—400 KW Ridgway 4-valve 275 V.
1—350 KW Ridgway Uniflow 250 V.
1—300 KW Skinner Uniflow 275 V.
1—250 KW Ames Uniflow 250 V.
1—125 KW Ridgway 4-valve 250 V. 3-wire

DIESEL ENGINE UNITS

1—625 HP Worthington, 240 V. 60 cy. gen.
1—440 HP Nordberg, 250 V. gen.
2—480 HP LeRoi RXISV (gasoline) eng. only
1—375 HP McInt. & Say., 240 V. 60 cy. gen.
1—300 HP McInt. & Say., 480 V. 60 cy. gen
2—250 HP Gen. Motors, 480 V. 60 cy. gen.
1—150 HP Buckeye 400 RPM engine only

WATER TUBE BOILERS

2—1409 HP B. & W. 650-lb., Stokers
1—1373 HP B. & W. 230-lb., Oil Fired
1—1320 HP Springfield 400-lb., Pulverizer
1— 607 HP Wickes 250-lb., Stoker
2— 600 HP Springfield 200-lb., Stokers
2— 560 HP Erie City 460-lb.
5— 492 HP Heine 180-lb., Stokers
2— 481 HP Springfield 225-lb., Pulverizer
2— 469 HP B. & W. 425-lb., Pulverizer
2— 323 HP Springfield 225-lb., Stokers

SYNCHRONOUS MOTORS

1—300 HP West. 60 cy. 2300 V. 720 RPM (NEW)
1—200 HP Ideal 60 cy. 4000 V. 514 RPM
2—200 HP Burke 60 cy. 2300 V. 600 RPM
1—100 HP G. E. 60 cy. 2300 V. 240 RPM (Super)
1—100 HP G. E. 60 cy. 4000 V. 1800 RPM

INDUCTION MOTORS—60 Cy.

1—1000 HP West. slip ring 220 V. 360 RPM
1— 700 HP G. E. sq. cage 2200 V. 1800 RPM
1— 500 HP G. E. slip ring 2200 V. 1800 RPM
1— 500 HP West. sq. cage 2200 V. 1800 RPM
1— 500 HP G. E. slip ring 2200 V. 3600 RPM
1— 400 HP G. E. sq. cage 2200 V. 600 RPM
1— 300 HP West. slip ring 440 V. 1200 RPM
1— 250 HP F.-M. slip ring 220 V. 1800 RPM
2— 120 HP G. E. sq. cage 220 V. 3600 RPM

MOTOR GEN. SETS—60 Cy.

1—1000 KW General Electric 600 V. DC
1— 300 KW Westinghouse 600 V. DC
1— 100 KW Westinghouse 125 V. DC
1— 50 KW Westinghouse 250 V. DC

ROTARIES—60 Cy.

1—2000 KW General Electric 600 V.
2—1750 KW General Electric 250 V.
1—1500 KW Westinghouse 250 V.
1— 500 KW General Electric 250 V.

FREQUENCY CHANGERS

1—2150 KVA G.E. 25/62½ cy. 750 RPM
1—1875 KVA G. E. 25/60 cy. 300 RPM
2—1500 KW West. 25/60 cy. 300 RPM
2—1000 KVA G. E. 25/60 cy. 300 RPM
1—1000 KVA Al. Chal. 25/62½ cy. 375 RPM
1— 938 KVA West. 25/62½ cy. 750 RPM
1— 600 KVA G. E. 60/25 cy. 300 RPM

TRANSFORMERS—1 Ph. 60 Cy.

4— 6667 KVA G. E. 79660/138,000-34500 V.
3— 2500 KVA Moloney 63/110Y-23/11.5 KV
1— 1500 KVA Pitts. 66000-33000 V. 3 ph.
4— 1500 KVA G. E. 66-13.2/4.6/2.3 KV
3— 750 KVA Pitts. 66000-33000 V.
3— 100 KVA G. E. 66000-6900/11000 V.
2— 7500 KVA G. E. 33000-13800 V. 3 ph.
4— 1500 KVA G. E. 33-13.2/4.6/2.3 KV
3— 100 KVA Moloney 33000-2400 V.
3— 75 KVA Moloney 33000-2300 V.
2—10000 KVA West. 26400-4580 V. 3 ph.
1— 6000 KVA West. 26400-2300 V. 3 ph.
2— 4000 KVA Pitts. 26400-13200 V. 3 ph.
3— 4000 KVA G. E. 26400-13200 V.
2— 1000 KVA G.E. 23000/11500-575 V.
1—10000 KVA West. 13200/4580 V. 3 ph.
2— 1000 KVA G. E. 11500/23000-575 V.
6— 1000 KVA West. 11000-2300 V.
3— 500 KVA L. M. 7200/12470Y-480 V. 3 ph. New
3— 500 KVA Pitts. 6600-2300 V.
1— 300 KVA Kuhlman 6900-460 V. 3 ph.
3— 150 KVA G. E. 4150-220 V. 3 ph.
1— 300 KVA West. 450-100 V. (Furnace)
3— 30 KVA West. 440-220/110 V.
4— 25 KVA West. 440-220/110 V.

OIL CIRCUIT BREAKERS

2—	400 A. 37 KV G. E. FHK0136	Outdoor
1—	400 A. 37 KV G.E. FK0136	Outdoor
2—	1800 A. 30 KV Kelman CB76	Outdoor
6—	400 A. 25 KV G. E. FK-136	Outdoor
4—	600 A. 15 KV G. E. FHK0139-24BS	Outdoor
1—	600 A. 15 KV G. E. FK037	Pole Type
2—	400 A. 15 G. E. FHK0136	Outdoor
1—	600 A. 15 KV West. O-221	Outdoor

PARTIAL LIST—WE HAVE ALL CLASSES OF POWER EQUIPMENT

BREW, WOLTMAN & CO., INC.

50 Church Street New York City 7, New York

ELECTRICAL EQUIPMENT—REBUILT and GUARANTEED

MOTORS—GENERATORS—MG SETS—TRANSFORMERS—CONTROLS

SLIP RING MOTORS

3 Phase—60 Cycle

QN.	H.P.	SPEED	MAKE	TYPE
5	52	550	G.E.	IQC-5013*
1	60	1200	G.E.	MT-B-343
1	60	570	G.E.	MTC-5546
2	60	580	Al.-Ch.	ANY
1	75	720	G.E.	MT-556
1	75	1750	West.	CI-653 C
1	80	575	G.E.	MTC-5352
1	100	1760	Al.-Ch.	ARY-223BS
2	125	430	G.E.	IL-16
1	150	385	G.E.	IM-17
1	150	490	West.	CW-956A
2	200	600	G.E.	IL-17
3 (New)	250**	296	West.	CW-20-53-15
2	300	514	G.E.	IM-17A
1	300	1200	West.	CW
1	400	505	West.	CW

*2 phase **50 cycle.

NEW D.C. MOTORS

25—Allis-Chalmers, 10 H.P. 1200 R.P.M., 230 Volt, D.C., EB-80, Dripproof, 40°, Ball Bearing.
20—Westinghouse 12.5 HP, 600 RPM, 230 volt, DC Marine Type SK-93, Totally Enclosed, Ball Bearing.

SQUIRREL CAGE MOTORS

3 Phase—60 Cycle

QN.	H.P.	SPEED	MAKE	TYPE
1	25	1140	West.	CCL
1	30	870	West.	CS-646
2	30	1150	G.E.	KT-326
1	50	900	G.E.	KT-346
1	50	850	West.	CCL
1	50	514	Howell	TEFC
1	75	1750	West.	CS-761
1	100	495	Al.-Ch.	AN
1	100	580	G.E.	IK-15
2	100	590	West.	CS
1	150	580	West.	CCL
5	150	1800	Howell	
5	200	580	G.E.	KT-5668
1 (New)	200*	2950	West.	CS-8120-TEFC

*50 cycle.

VARIABLE VOLTAGE DRIVES

8—40 HP, General Electric Variable Voltage Ward Leonard Drives consisting of:
1—40 KW, 250 Volt, Induction M-G Set, with two auxiliary 5 KW generators with exciters.
1—40 HP, 250/1500 RPM, Type CD-1441 DC Motor.
2—Auxiliary, 5 HP, 1750 RPM Type B-284 DC Motors.
1—Enclosed magnetic control providing jog forward, jog reverse, run, fast, slow, and stop. Complete with motor operated field rheostat.

The Above Listings Are Representative of Items Available for Prompt Shipment from Our Cleveland Warehouse. We Also Have a Large Stock of Synchronous Motors, Constant and Adjustable Speed DC Motors, Rotary Converters, Circuit Breakers and Control Equipment.

ELECTRIC GENERATOR & MOTOR CO.

4521 HAMILTON AVE. CLEVELAND 14, OHIO
Phone: ENdicott 5656 • Established 1900

BOILERS

NEW and USED

All makes & sizes for prompt shipment several attractive assorted sizes.

SPECIAL OFFER
400-HP . . . 175 lbs. Stirling Boilers
3—250 HP Heine Water Tube Type

J. F. DAVIS CO.

122 S. Michigan Ave. CHICAGO
Telephone Harrison 0755

TURBO GENERATORS

1—1250 KW General Electric Turbo-Generator, Type ATB, Form HT, 3600 RPM, direct-connected exciter, Wheeler Jet Condenser.

1—2000 KW General Electric Turbo-Generator, 180 lb. pressure, 3600 RPM Generator, Type ATB, 600 Volt AC, 2403 Amp. with Westinghouse-LeBlanc Jet Condenser.

1—1500 KW Westinghouse Turbo Generator with Surface Condenser 4200 sq. ft.

Republic Textile Equipment Co.

40 Worth Street, New York 13, N. Y.
Phone: COrtlandt 7-1891

Write—Wire—Phone us if you don't see the item you need. This listing is only a part of our large stock.

M-G SETS

300 KW. Gen. Elec. type MPC gen. DC 170 volts 1760 amp. coupled to 450 HP G.E. motor DC 250 V. 1150 RPM (can furnish A.C. drive).
150 KW Gen. Elec. type MPC gen. DC 250 V. coupled to 225 HP sq. cage motor 3/60/440 V. 1200 RPM, 3 brg.
150 KW Gen. Elec. type MPC gen. DC 125 V. coupled to 225 HP sq. cage motor 3/60/2200 V. 1200 RPM, 3 brg.
50 KW Cr. Wheeler type CC generator DC 125 V. coupled to 80 HP C-W motor sq. cage 3-60-220/440.
40 KW Martin rotary converter, input 3/60/220 v., output DC 230 v., with panel.
37½ KVA Whse. AC gen. 3/60/240 V. coupled to 50 HP Whse. SK motor DC 230 V. 1150 RPM. 3 brg.
30 KW Gen. Elec. CD 103 gen. DC 60 v. 500 amp. coupled to 45 HP G.E. KT 532 motor 3-60-220/440 v.

Others available—special units built to order.

SPECIAL — 8 — 400 amp. Hobart Arc Welders, 220/440 V. AC Drive, Like New.

SQUIRREL CAGE MOTORS

3 Phase—60 Cycles—220 or 440 Volts

Qua.	H.P.	Mfr.	Type	Speed
1	800	Gen. Elec.	I-K	1800
1	250	Gen. Elec.	I-K	600
3	165	Gen. Elec.	I-K	1800
1	150	G.E. 2200 V.	I-K	1200
1	60	Gen. Elec.	I-K	3600
3	50	Whse. 2200 V.	CS	900
1	50	Gen. Elec. vertical	KT	1200
1	40	Gen. Elec.	I-K	900
2	40	G.E. vertical	KT532	1200
1	30	Gen. Elec.	I-K	720
1	25	Gen. Elec.	I-K	600
1	25	Whse.	CS	900

D. C. MOTORS

H.P.	Mfg.	Type	Volts	Speed
450	Gen. Elec.	MPC	230	1150
125	Cr. Wheeler	125H	230	500
100	Cr. Wheeler	101H	230	550
75	Cr. Wheeler	125H	230	350/750
75	Whse.	813	125	475
75	Gen. Elec.	DLC	230	400
65	Cr. Wheeler	65H	230	600
65	G.E. Northern	C	230	375/750
60	Diehl dynamom.	R10	250	500/2000
50	Whse.	SK	230	1150
50	G.E. Sprague	LC	250	700
50	Whse.	SA	230	450/1350
50	Cr. Wheeler (5)	50H	230	700
50	Whse	SK	230	500/1500
40	Whse.	SK153	230	575/1150
40	Gen. Elec.	DLC	230	750
40	Roth	S	115	850
35	Fair. Morse	TRC	230	1150
30	Sprague	dynamom.	250	800/2000
25	Gen. Elec.	DLC	115	750
25	Roth	elevator	230	725
25	Whse. enclosed	SK	230	600
25	Whse.	SK	230	950
25	Sprague dyna.	IC	115	700/1500
25	Gen. Elec.	FFC32	230	800
25	Star b.b.	SB15	230	1750
20	Imperial int. dty.	D37	230	1200
20	Gen. Elec.	LC	230	575
20	Gen. Elec.	DLC	230	230/1500

25 CYCLE MOTORS

H.P.	Mfg.	Type	Speed
450	Whse. 2200 v.	CW sl. rg.	750
150	Whse.	HD sl. rg.	500
100	Whse.	CCL sq. cg.	500
75	Gen. Elec.	I sq. cg.	750
50	Allis Ch.	ANY sl. rg.	1500
30	Gen. Elec.	IM sl. rg.	750

SYNCHRONOUS MOTORS

H.P.	Mfg.	Type	Volts	Speed
750	Allis Ch.		220/400	1200
300	Whse.	ped.	220/440	900
200	Elec. Machy.		220/440	600
150	Elec. Machy. New	SPF	220/440	360
50	Gen. Elec.	TS	220/440	900

AIR COMPRESSOR — 14x12 Ing. Rand 500 CFM, 100#, with Tank—BARGAIN

CENTRIFUGAL PUMPS
8" Alberger, 2000 gpm @ 80 ft.
6" Platt, 1000 gpm @ 230 ft.
8" Worthington, 2000 gpm @ 200 ft.

SLIP RING MOTORS

3 Phase—60 Cycles—220 or 440 Volts

Qua.	H.P.	Mfg.	Type	Speed
1	400	Gen. Elec. 3 brg.	I-P	450
1	300	Burke	EMV	225
1	250	Cr. Wheeler	SR	600
1	200	Burke	EMV	514
2	200	G. E. 2200 v.	I-M	360
1	150	G.E. 2200 v. vert.	I-M	1200
1	100	Whse. 2200 v.	HF	600
1	75	Allis Ch. 2200 v.	ANY	720
1	60	Whse. 2200 v.	CW657	1800
1	60	Gen. Elec.	I-M	720
1	50	Whse.	MW332	900
1	50	Gen. Elec.	I-M	600
1	40	Gen. Elec.	MT532	1200
2	40	Gen. Elec.	M546	514
2	40	Allis Ch.	ANY	450
1	40	G.E. 550 v.	MT536	900
1	37	G.E. int. duty	ITC	600
3	35	Lancashire b.b.	late	1800
2	30	Allis Ch.	ANY	900
1	25	Gen. Elec.	I-M	1200
1	25	Wagner	19TBR	1200
1	25	Whse.	CW	720
1	20	Wagner	19TRS	900

D. C. GENERATORS

KW	Mfr.	Type	Volts	Speed
300	Gen. Elec. 1 brg.	MPC	125/170	1150
100	Fair. Morse	TR	250	800
75	Whse.	S	125	600
60	Gen. Elec.	DLC	250	450
50	Cr. Wheeler	CC	125	1800
50	Cr. Wheeler	CCD	250	850
35	Gen. Elec.	DLC	250	900
30	Lincoln b.b. 600 amp.		50	1200
25	Whse.	S	125	1200
25	Gen. Elec.	DLC	125	900
25	Gen. Elec.	RC	250	900
25	Whse. (3) b.b.	SK113	250	1800
20	Allis Ch. (2)		125	475
16	Cr. Wheeler	CCD	125	415

SPECIAL — 3 — Oil Gear Co. Pumps, 1100 lbs. 104 gpm., on steel base — BARGAIN.

60 CYCLE A.C. GENERATORS

KVA	Mfr.	Type	Volts	Speed
300	Whse.	ped.	240/480	900
300	Elec. Machy. 3 brg.		240/480	720
200	Gen. Elec.	ATB	2300	600
165	Elec. Machy.	BRKT	240/480	900
150	Allis Ch. 25 cycle		240/480	600
100	Cr. Wheeler		240/480	600
75	Gen. Elec.	ATB	240/480	1200
31	Whse. (4)	b.b.	120/208	1200
10	Whse. (5) NEW	b.b.	240	1200

ARTHUR WAGNER COMPANY

1436-38 W. RANDOLPH STREET — CHICAGO 7, ILL. — MONroe 7409

POWER PLANT EQUIPMENT

Special Offerings

TURBO-GENERATORS

1—3000 KW, 2300 V. Cond.
1—2500 KW. 2300 V. Cond.
1—1250 KW. 2300 V. Cond.
1— 250 KW. 240 V. N. C.
1—2000 KW. 600 V. Cond.
2—1000 KW. 2300 V. Cond.
1— 750 KW. 480 V. N. C.
1— 500 KW. 440 V. N. C.
1— 500 KW. 125 V. D. C.
1— 375 KW. 440 V. Cond.
1— 120 KW. 440 V. N. C.

ENGINE GENERATORS

1—540 KW. Uniflow 480 V.
1—150 KW. 480 V.
1—600 H.P. Uniflow Eng.
1—163 KW. 550 V.
2—280 KW. 440 V.
1—600 KW. 2300 V.

TURBINES ONLY

1—375 H.P. with gears
1—210 H.P. Terry 250#
1—100 H.P. G.E. with gears

BOILERS

1—1390 H.P. 400# Coal
1— 990 H.P. 200# Coal
1— 620 H.P. 200# Coal
3— 500 H.P. 160# Coal
1— 360 H.P. 190# Coal
2— 310 H.P. 250# Coal
2— 100 H.P. 100# Oil
2— 175 H.P. 200# Oil
1— 200 H.P. HRT 160#

AIR COMPRESSORS

2—3400 CFM 100# Motor
1—3000 CFM 100# Motor
1—1972 CFM 100# Motor
1—1573 CFM 100# Motor
2—1228 CFM 100# Motor
1—1330 CFM 50# Steam
1—1700 CFM 100# Steam
1— 600 CFM 350# Steam
1—5000 CFH 600# Belted
1—1000 CFH 3000# Belted

STOKERS

2—Combustion Type E, New
1—CE. Combustion Spreader Type

Write or wire for additional data and prints.

A. LEE ELLIS CO., U. S. Mchy. Bldg., Boston, Mass.

The Buyer Must Be Satisfied—Always

SYNCH. CONVERTERS

500 KW G.E. 250 D.C. 2300/4000 A.C. 1200 RPM
500 KW AL-CH. 250 D.C. 2300/4000 A.C. 1200 RPM
300 KW G.E. 600 D.C. 2300/4000 A.C. 1200 RPM
150 KW WEST. 250 D.C. 2300/4000 A.C. 1200 RPM

MOTOR GENERATORS

150 KW G.E. SYN. 250 V. 2300/4000 A.C. 900 RPM
150 KW G.E. SYN. 600 V. 2300/4000 A.C. 1200 RPM

Each unit listed above is owned by us and is available now for immediate purchase

WALLACE E. KIRK CO.

Incorporated

502 Grant Building, Pitsburgh, Pa.

DIESEL GENERATOR UNIT

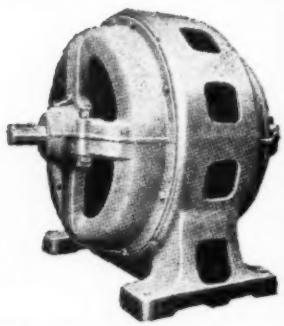
1500 H.P.—1250 KVA

Nelseco — General Electric
Modern, Supercharged, Bosch Injection
3/60/2400, 300 RPM, All Accessories, Complete
Immediate Stock Delivery Rebuilt

A. G. SCHOONMAKER COMPANY
50 Church St., New York 7, N. Y.
Phone Worth 2-0455

$1,000,000 INVENTORY AVAILABLE

MOTORS
GENERATORS
TRANSFORMERS



LARGEST SELECTION IN AMERICA

ASK FOR CATALOG P-100

ELECTRIC EQUIPMENT CO.
TELEPHONES: GLENWOOD 6783-6784-6785
63 CURLEW STREET, P. O. BOX 51 ROCHESTER 1, N. Y.

TURBO GENERATORS

750 KW., 3 ph., 60 cy., 480V. 3600 Allis Chalmers to a Moore extraction type Turbine with board.

500 KW., 3 ph., 60 cy., 480V. Westgh. non cond. Turbo Generator with board.

937 KVA., 3 ph., 60 cy., 2300V. Gen. Elec. cond. Turbo Generator.

ROTARY CONVERTER

1—1500 KW., 250 V. Westgh. complete.

1—156 KVA., 3 ph., 60 cy., 240 volt Gen. Elec. to an 8 cylinder Buffalo engine only 5 years old, little used.

The above are just a few of the thousands of items we have in Motors, Generators, Turbo Generators, Engine Generators, Motor Generators, Transformers, Circuit Breakers, etc. Please send us your inquiries.

What have you for sale?

KEYSTONE
Power Plant Equipment Company
8493 Hegermen St., Phila. 36, Penna.

Electrical Equipment

C. B. LOCKE CO.
P. O. BOX 3227
TEL. 38-136
CHARLESTON, W. VA.

NEW and REBUILT

We build SUB-STATION equipment to fit your requirements. Highest quality A. C. and D. C. Motors, Control Equipment and Transformers.

TURBO ALTERNATORS

Complete with Auxiliaries and Control Equipment

1—3650 KVA, 3600 RPM, 2300/3/60, Whse
1—3125 KVA, 3600 RPM, 2300/3/60, Whse

MOTOR GENERATOR SETS

3 base 60 cycle

1—200 KW, Whse, 900 RPM, 250 V.D.C. to 290 HP 2200 volt Syn. complete with control equipment
1—150 KW Ridgeway, 900 RPM, 250 V.D.C. to 225 HP, 2300/4160 volt Syn. complete with control equipment
1—65 KW, G.E., 1200 RPM, 125 V.D.C. to 125 HP, 2300 volt Ind. complete with control equipment

SYNCHRONOUS ROTARY CONVERTERS

6 phase 60 cycle

Qu.	KW	Make	Speed	D.C.V.	Trans. V.
1	1500	Whse.	450	250	2300/4160
1	500	Whse.#	1200	250	2300
1	500	Whse.	1200	600	##
1	300	Whse.	1200	275	##
2	300	Whse.	1200	600	##
2	150	Whse.	1200	275	##

Booster type.
New Transformers, your specs., 4 to 5 months.

Large Size Motors available from stock.

BOILERS

10 to 1000 H.P.
NEW-USED
RECONDITIONED
Steam, Gas and Electric
Power Equipment

J. PARKER THOMPSON CO
[illegible] 38th AVE., NEW YORK CITY
MURRAY HILL 2-5740

COMPRESSORS
Vacuum Pumps

New & Guaranteed Rebuilts
Stationary & Portable
SALE OR RENT
Worthington Authorized Distributors

AMERICAN AIR COMPRESSOR CORP.
4704 Dell Ave., — N. Bergen, N. J.
N. Y. Phone Ch 4-7665. N. J. Phone Union 5-4848

IRON FIREMAN STOKERS

Two #4A-C. L. C.
Rated 500 lbs. per hour
Equipped with 3 H.P. Motors

Bargain

PERFECTION GEAR CO.
HARVEY, ILLINOIS

FOR SALE

SCOTCH MARINE BOILER

Operating pressure 150 PSI, capacity 12,000 pounds per hour, main drum diameter 10 feet, tube length 16 feet, with the following equipment—
1—Boiler flue and damper.
2—Cochrane feed water heater with a capacity of 25,000 pounds per hour.
3—H B C steam atomizing oil burners.
4—Hammel pump set.
5—Kole Master stokers.
No dealers.

SECURITY MILLS, INC.
Box B Newton 58, Mass.

DIESEL UNITS

625 HP Cooper Bessemer 240 V.—D.C.
300 KVA Fairbanks Morse 2400 V.
2—100 KW Chicago Pneu 250 V. D.C.
250 KW Busch Sulzer 240 V.
250 H.P. Busch Sulzer 257 rpm. Engine.
192 KW McIntosh Seymour 2300 V.
100 KW Busch Sulzer 2300 V.
2—11,500 & 20,000 Gal. Steel Tanks.
80 H.P. F.M. 300 rpm. Diesel Engine.
R. C. STANHOPE, Inc., 60 E. 42nd St., N.Y. 17, N.Y.

APPLICATION ENGINEERS

3000 KW 200 lb. GE Cond. Turbine Set.
2—140,000 lb. Cap. 650 lb. WP Boilers.
200 KVA 480 Volt AC Ridgway 4-Valve Eng. Set.
360 HP 240 Volt AC Fairbanks Morse Diesel Set.
180 HP 2300 Volt AC Fairbanks Morse Diesel Set.
100 HP Fairbanks Morse Diesel Engine with Clutch.
50 KW M.G. Set 440 AC to 250 DC.
HOWARD B. JOHNSON & ASSOCIATES
53 W. Jackson Blvd. Chicago 4, Ill.

There is some very sound apparatus available.
We can recommend these turbo generators:

600 KW Condensing 60/3/480—135#—Jet Cond.—1920—West Coast
1500 KW Condensing 60/3/480—150#—Jet Cond.—1922—West Coast
2000 KW Condensing 60/3/600—200#—Sur. Cond.—1920
30,000 KW—3 unit installation—450# 750° F TT (Topping unit with Condensing Turbines)
2—1250 KW Extraction 60/3/480—200# ISP 15# GBP—1924—rebladed and rebuilt
1—1000 KW Extraction 60/3/2400—200# ISP 15# GBP—1923—excellent maintenance
Non-Condensing Units—500-1500-2000—and a few mixed pressure units

There are a few 25/60 true cycle Freqs.

500—1500—2000—2500 KW

A small number of good transformers have been located

100—4000 KVA—OISC—power and distribution

Some engine generators are available — this one's very good

600 KW Skinner Vertical Uniflow 250 V DC 3-wire

And we can supply a number of good Diesels

2500 KW Complete Plant—utility maintenance—60/3/2400 V with
2—400 KW and 2—850 KW McIntosh-Seymour units
180 KW Plant; 1—85 KW, and 1—95 KW Winton units 60/3/240 V

These are all pretty good boilers — recently inspected:

1—260 HP—200#—stoker—4-drum bent tube unit—1924
1—612 HP—200#—Stirling—1922
2—1000 HP—250#—stokers—4-drum bent tube units—1925—rebuilt
1—70,000#/Hr. 200# 100°—pulverizers—built 1918—rebuilt 1930
1—180,000#/Hr. Plant—250# 600°—pulverizers—built 1925—used 6 years

Memo to the Chief Engineer:

.....reasonably modern power units are practically non-existent in today's market; engineering plans are being rescheduled for new equipment installation in 1949 and 1950 as a result. We think it's time to consider.....

— Analysis of load changes can release machinery now
— Your semi-standby units can be sold now
— Your scheduled future releases have a value in today's market

We'd like to find some of these units:
Turbo Generators — Condensing

1500-3000-5000-7500 KW mid-pressure (200/250#)
and one —
500 KW N/C Direct Current 250 V (200# ISP—10/15#GBP)

PAUL STEWART & CO., INC.
UNION TRUST BUILDING **CINCINNATI 2, OHIO**
Over 50 Years of Service

BOILERS-TURBINES

2—400 H.P. Erie City, type-E. stokers, OHIO, PENN'A & ASME stamping.
2—400 H.P. Springfield, oil burners, N. J. & ASME stamping.
2—25,000# per hour, 425#, 650 T.T. boiler & turbine complete plant (1) 1500 K.W. bleeder, (1) 1500 K.W. back pressure turbo's, National Board boilers.

H. P. BREARLEY
3423-91st Street
Jackson Heights, N. Y.

—TRANSFORMERS—

TRANSFORMERS WANTED

in operating condition or burnt out. Mail us list giving complete nameplate data and stating condition.

We Rewind, Repair and Redesign all Makes and Sizes
ALL TRANSFORMERS GUARANTEED FOR ONE YEAR
Write for Catalog No. 135-F

THE ELECTRIC SERVICE CO., INC.
"AMERICA'S USED TRANSFORMER CLEARING HOUSE"
STATION M Since 1912 CINCINNATI, OHIO

FOR SALE

Power plant equipment. Steam, Diesel, electrical, boilers, engines, turbines, generators, new or used.

PENN MACHINERY COMPANY
Jackson, Miss.

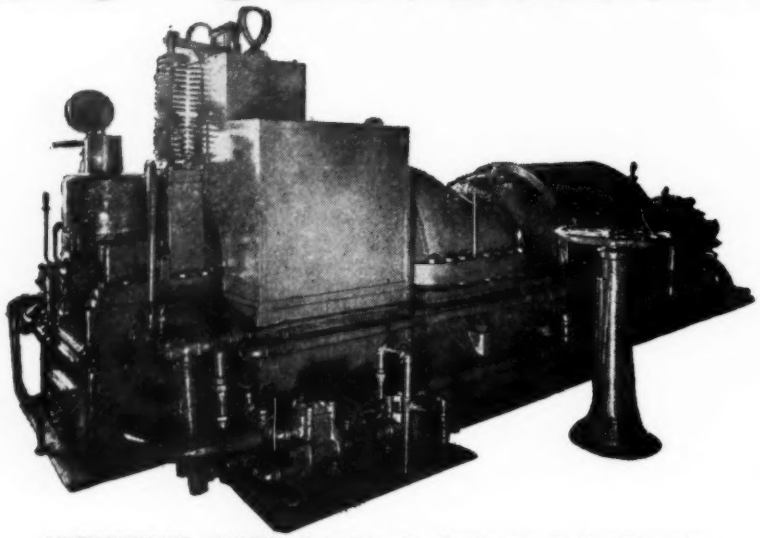
5 Ton P & H Heavy Lift
ELECTRIC TRAVELING HOIST
3/60/220/440 floor controlled
IRON & STEEL PRODUCTS, INC.
13488 S. Brainard Ave., Chicago 33, Illinois
"*ANYTHING* containing IRON or STEEL"

FOR SALE

Skagit Double Drum Hoists with Chrysler gas power unit—4 speed transmission—Heavy duty—all steel—7" alloy steel main shafts. New—Crated for export with spare parts.

COMMERCIAL EQUIPMENT COMPANY
2937 Ford Street Oakland, Calif.

TURBO-GENERATORS



WESTINGHOUSE, 1000-KW. Aut. Extraction-Condensing Turbine-Generator

A Partial List of our Stock is noted Below

20000—KVA-West. Surf.Cond. 250/400# 2300-V
2— 1250—KVA-West. 250# 2300-V
6250—KVA-G.E. Surf.Cond. 200# 2300-V
6250—KVA-A-C. Non.Cond. 425# 185#BP
3750—KVA-G.E. Surf.Cond. 200# 2300-V
2500—KVA-G.E. Surf.Cond. 200# 2300-V
1875—KVA-G.E. Cond'sing. 200# 2300-V
1565—KVA-G.E. Surf.Cond. 150# 2300-V
1250—KVA-West. 200# 2300-V
1250—KVA-A-C Non-Cond. 150# 480-V
1250—KVA-West. Surf.Cond. 200# 2300-V
937—KVA-A-C Condens'g 2300-V

Also Specialists in Diesel Engines, Boilers & Genl. Power Plant Eqpt.

WE OWN and CAN SHIP FROM STOCK

450-HP Baldwin Diesel Engines
320-HP Atlas Imperial Diesel Engines

Also Any Other Size or Capacity Diesel Engine Desired

WRITE OR WIRE US

CHARLES WEAVER & COMPANY, DETROIT, MICH.

4045 Penobscot Building—Telephone Cadillac 1340-1

POWER PLANT SPECIALISTS

SPECIAL OFFERING

2-1500 H.P. 600# Pressure Unused Water Tube Type Boilers, with all Trim including Super Heaters, Oil Burners, Economizers, and Boiler Controls.
Also Boilers 150-1500 H.P. and upward (at various pressures).

NOTE TO READER

The rapid turnover of our stock has made us feel we cannot publish a complete list of current offerings.

State your needs—We will post you promptly.

Our present stock consists of over 5000 items, in our warehouse consisting of all types of TURBO GENERATORS, SWITCHGEAR, AIR and OIL CIRCUIT BREAKERS, RELAYS of all types, TRANSFORMERS, PUMPS, 800 VALVES—NEW and USED, up to 1500# pressure, and other items used in Industrial and Power Plant Construction.

HOWE BROTHERS

324-328 PEARL ST., NEW YORK 7, N. Y.

Phone—Worth 2-2708—2709—2710

PIPE

CUT TO SKETCH ⅛"-24"

METROPOLITAN
PLUMBING SUPPLY CO., INC.
INDUSTRIAL AND MARINE SUPPLIES
LARGE SURPLUS STOCK
STEEL-WROUGHT IRON-CAST IRON
BRASS-COPPER-CEMENT LINED PIPE
Power Plant Valves & Engineering Specialties - Jenkins - Fairbanks & Sarco Valves
313 East 31st Street, N.Y.C.
HOURLY NATION WIDE SHIPMENTS
Phone MUrray Hill 3-3408
FLANGED VALVES & FITTINGS

87.5 KW G.E. M/G Set 250 Volts DC driven by synchronous motor .85 P.F. 1200 rpm complete with controls

Designers and Manufacturers of Special Electrical Equipment

ELECTRIC APPARATUS REPAIR CO.
1400 N. 6th Street, Phila. 22, Pa.

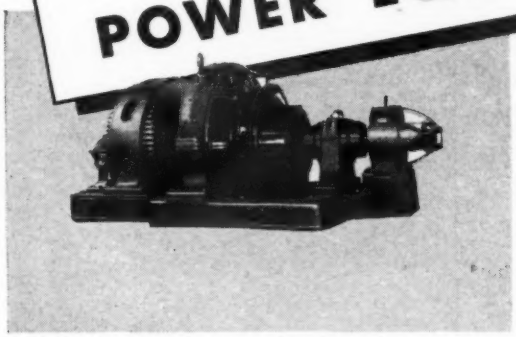
FOR SALE

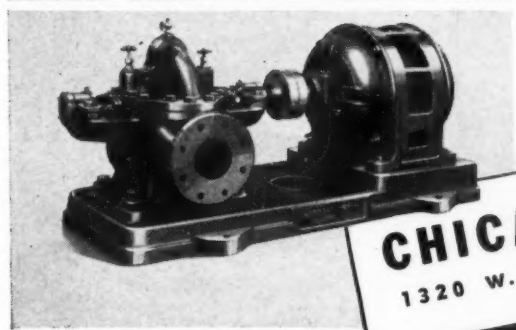
Two-200 H.P. D.C. Motors & Starters
Type S K 230 Volts 1200 RPM

CENTRAL PIPE & SUPPLY CO.
2109 No. Broadway St. Louis 6, Mo.

"Single Motors or Complete Power Plants"

GUARANTEED POWER EQUIPMENT





- - A Complete Service
REPAIRING — REBUILDING
AND RENTAL

▼

SPECIAL OFFERINGS FROM
CHICAGO'S LARGEST STOCK

GAS ENGINES
Direct Current

Qu.	KW	Make	Volts
2	5	Globe	110 DC
1	5		115 DC
2	5	J. Wind	32 DC
2	5	Waukesha	115 DC
1	2.5	B. Stratton	110 DC
1	2	Wisconsin	115 DC
3	1.5	Kohler	115 DC
1	.6	Homelite	110 DC
15	.5	Climax	110 DC
2	.5	Delco	120 DC
5	.5	B. Stratton	150 DC
12	.5	Jacobson	32 DC
50	.4	Champion	12 DC
10	.3	Pioneer	110 DC
1	.25	Pioneer	110 DC
3	.25	Leach	115 DC
40	.25	B. Stratton	115 DC
1	.25	B. Stratton	110 DC

GAS & DIESEL ENGINES
Alternating Current

Qu.	KW	Make	Volts
1	50	Wtg.	127/220
1	31.25	Wtg.	208/120
3	30	Century	127/220

TRANSFORMERS
Dry type Air-Cooled

Qu.	KVA	Make	pri.	sec.
3	100	Wtg.	240/480	120/240
3	100	Wtg.	480	480/240
3	50	Wtg.	460/230	230/115
8	37½	Wtg.	440	220
7	25	Wtg.	440	220

FREQUENCY CHANGERS

1—10 HP Louis Allis, type OH, 3 phase, 60 cycle, 220/440 volt synchronous motor, direct connected to 33 amp. 3-180-220, speed 1800 RPM.

1—25 HP Allis Chalmers, type AN, 3 phase, 60 cycle, 220 volts, direct connected to 25 KW, 3/240/20, speed 1750 RPM.

CHICAGO ELECTRIC CO.
1320 W. 22nd ST., CHICAGO 8, ILLINOIS

PHONE
CANAL
2900

MOTORS • GENERATORS • TRANSFORMERS

MOTORS
3 phase 25 cycle, 220/440 Volts

H.P.	Make	Type	Frame	RPM
5	West.	CS		750
5	West.	CS		750
5	West.	CS		750
5	West.	CS	453	750
5	West.	CS	453	750
5	G.E.	KT	948	1430
5	G.E.	KT	948	1430
5	G.E.	KT	948	1430
10	G.E.	KT	312	750
10	Wagner	19TBM		750
10	Wagner	19TBM		750
10	Wagner	19TBM		750
15	G.E.	I Form K		750
15	West.	CS	4052	750
15	West.	CS	573	750
15	West.	CS	573	750
15	West.	CS	573	750
15	G.E.	KT	303	1500
20	West.	CS		730
20	West.	CS	645	715
20	West.	CS	645	715
20	West.	CS	405	675
20	West.	CS	405	675
25	West.	CS		730
25	West.	CS		715
40	G.E.	I Form K		750
40	G.E. (S. R.)	MT	347	750
40	G.E. (S. R.)	MT	347	750
50	G.E. (S. R.)	MTC	5537	750
75	G.E. (b.b.)	KT	557	750
75	G.E.	KT	559	500
75	G.E.	I Form K		500
75	G.E.	I Form K		500
75	G.E.	I Form K		500
75	G.E. (2200 v.)	I Form K		750
100	G.E.	I Form K		750
100	West.	CS		750
100	West. (2200 v.)	CS	871C	730
100	West. (2200 v.)	CS	871.52C	1460
100	West. (2200 v.)	CS	871.52C	1460
125	West. (S. R.)	CW		480
150	G.E.	I Form K		365
150	Crocker Wh.	75R		725
150	G.E. (2200 v.)	I Form K		750
150	G.E. (2200 v.)	I Form K		750
150	Allis Ch.	Slip Ring		720
150	G.E. (2200 v.)	KT b.b.	557Y	1470
200	West. (2200 v.)	CS	1013	480
200	G.E. (2200 v.)	I Form K		485
200	G.E. (S. R.)	I Form M		480
200	G.E. (S. R.)	I Form M		480
200	West. (S. R.)	CW	1011	480
200/400	G.E. 2 Sp.	K	569B8	740/1485
225	Elec. Mach. (2200 v.)	Synchronous		500
300	West. (S. R.)	CW		500
500	G.E. (2200 v.)	KT		487
500	G.E. (550 v.)	I Form K		500

MOTORS
25 Cycle—3 Phase—550 Volt

				RPM
7 — 25 HP	West.	Type CS		3/25/550/750
1 — 30 HP	West.	Type CS		3/25/550/750
1 — 60 HP	West.	Type CS		3/25/550/750
1 — 65 HP	West.	Type CS		3/25/550/500
1 — 100 HP	West.	Type CS		3/25/550/750

TRANSFORMERS

3—150 KVA West., OISC—25/1/2300/460.
3—200 KVA West., OI8C—25/1/2300/460.
3—500 KVA Pitts., OI8C—25/1/2300/230/460.
1—2500 KVA Gen. Elec. 60/3/22000/2200 V.

3 phase, 60 cycle, 220/440 Volts

HP	Make	Type	RPM	Serial No.
15	Westinghouse	CS	1200	1883285
15	Westinghouse	MS	1200	944593I
20	Westinghouse	CS	1200	2160500
20	Westinghouse	MS	1200	1050826
20	Westinghouse	CS	1800	1863526
20	Westinghouse	CS	1800	2695044
25	Westinghouse	MS	1800	1562026
25	Westinghouse	MS	1800	1334763
25	Westinghouse	CS	1200	2286768
25	Westinghouse	MS	1200	1197673
25	Wagner	BP	1200	126906
30	Westinghouse	MS	1200	1197674
30	Fairbanks-Morse	V-H-10D	1800	43476
40	Westinghouse	CS	900	1896969
40	General Electric	I-K	1800	73318
40	Westinghouse	MS	1800	1506808
40	General Electric	I-K	1200	181444
40	Westinghouse	MS	1200	1027421
50	Westinghouse	MS	1800	1289389
50	Westinghouse	MS	1200	854410
50	Westinghouse	CS	1800	2691183
50	General Electric	14	1800	181444
50	General Electric	KT-352	720	
50	Allis Chalmers		1800	3K28825
60	Reliance		1200	B11458
60	General Electric	I	1800	292596
60	Westinghouse	CCL	1800	329654
60	Robbins-Myers	K	1800	P515362
60	Triumph		1800	C14248
60	Westinghouse	CCL	1200	854121 (2200 v.)
100	Westinghouse	CCL	1800	1043213
100	Westinghouse	CCL	1800	765231 (2200 v.)
125	Westinghouse	CS	1200	2318625
150	Westinghouse	CS	1800	2429726
150	Westinghouse	CCL	900	438385
150	Westinghouse	CS	1200	4572596 (2300 v.)
150	General Electric	I-K	1200	
150	Westinghouse	CCL	720	888349 (2200 v.)
200	General Electric	I-K	900	232917 (2200 v.)
200	Westinghouse	CCL	900	919537 (2200 v.)
250	General Electric	I-K	600	2246334
300	General Electric	I-K	720	2357743
400	General Electric	I-K	900	2347845

SLIP RING MOTORS
3 phase, 60 cycle, 220/440 Volts

HP	Make	Type	RPM	Serial No.
20	Westinghouse	CW644C	675	8009992
20	General Electric	MT332	545	3889010
30	Westinghouse	HF	1745	4558408
40	Westinghouse	CW748	690	4406823
250	Allis Chalmers	3 bearing	505	104390 (2300 v.)
400	General Electric	I-M	900	224674
400	General Electric	I-M	900	246762

MAGNETIC CONTACTOR

1—300 H.P. Cutler Hammer, Across the Line Contactor. 3 Phase, 25 Cycle, 440 Volts.

25 CYCLE GEARHEAD MOTORS

8—10 HP. Westinghouse Frame. 364. Enclosed 1500/378 RPM.
15 HP. Master Frame 405 Enclosed 1400/416 RPM.

SPECIAL DC MOTORS

1—40 H.P. Reliance Ball Bearing Drip Proof Type T-385-T 230 V D.C. 400/1500 RPM.

1—125 H.P. Gen. Elect. 230 V. D.C. Motor. 1750 RPM.

1—40 HP Reliance Variable Speed 220 v. DC. Drip-proof Ball Bearing 400/1500 RPM.

1—45 HP. G.E.

MOTOR GENERATOR SET

200 KW Westinghouse Synchronous. Generator Type SK 201, 250 V. D.C. 800 Amps. 900 RPM Motor. 290 HP. Synchronous. 3 Phase 60 Cycle 900 RPM. Can be wound for 440 V. or 2200 V. Complete with panels, exciter, and starting equipment.

CAPACITORS

3—30 KVA Gen. Elect. Pyranol Filled Capacitors 3/60/2300 v.

3—60 KVA Gen. Elect. Pyranol Filled Capacitors 3/60/2300 v.

ERIE ELECTRIC CO., INC.
124 CHURCH ST. BUFFALO, N. Y.
CL. 4758

REBUILT POWER EQUIPMENT

READY TO SHIP!

SLIPRING MOTORS—3 PH., 60 Cy.

H.P.	Make	Volts	R.P.M.	Type
400	Westg.	2200	435	CW
200	G.E.	220/440	1200	M-1
150	G.E.	220/440	1200	M-1
50/60	Westg.	220	1800	CW
50	Chandeysson	220/440	1800	
40/40	Westg.	220/440	1200	CW
20	Westg.	220	575	CW
15	Triumph	220	1150	
2.25	Northwestern	440	1080	HEW1½
½	Howell	220	1800	

ALTERNATING CURRENT MOTORS
3 ph. 60 cy.

H.P.	Make	Volts	R.P.M.	Type
100	G.E.	220	1745	I
50	Westg.	440	1200	CS
40	Westg.	440	870	CS
25	Westg.	440	1200	CS
20	Westg.	440	860	CS
2/20	Westg.	220/440	1750	CS drip proof
15	Westg.	440	720	CS
15	G.E.	220	900	ITC
15	Triumph	220	1150	
10	Westg.	440	900	CS

COMPRESSORS

2—315 cu. ft. 100# pres. Ingersoll-Rand Models 315 and 315A Portable Air Compressors with 105 HP. Waukesha Oil Engines complete with accessories.
1—610 cu. ft. 100# pressure Burry Horiz. Compressor.

VARIABLE SPEED MOTORS—
230 VOLT D. C.

H.P.	Make	R.P.M.	Type
50	Westg.	250/750	SK
25	Westg.	600/1200	SK
20	Westg.	500/1500	SK
15	Reliance	500/1800	
15	Westg.	875/1600	SA
10/15	Electro Dy.	600/1200	
10	Westg.	800/1600	SA
10	Cr. Wh.	690/895	CMC
10	Reliance	850/1700	
10	J.C. Curran	950/1230	
10	G.E.	625/1250	LC
10	Westg.	565/1130	S-6
10	Westg.	400/1600	SA
7½	Westg.	450/1800	SX
7½	Westg.	650/1300	
7½	Westg.	425/850	SK
7	Westg.	660/1050	S
4	G.E.	850/1700	LC-8
3	G.E.	400/1200	RLC-114
3	Roth	500/1000	RS

SERIES WOUND MOTORS

H.P.	Make	Volts	R.P.M.	Type
175	G.E.	230	475	MD
50	Cr. Wh.	230	500	SM
35	Westg.	230	550	49D
32	G.E.	230	450	801
32	Shaw	230	485	5L2E
28	Westg.	239	395	904
25	Westg.	230	600	MT
15	West.	220	650	
15	Cr. Wh.	220	270	SM
10	Westg.	230	750	MT-00
7½	Westg.	230	725	L
7½	Westg.	230	975	S1
3½	Westg.	230	1200	L

230 VOLT DC MOTORS

H.P.	Make	R.P.M.	Type
80	Westg.	490	76-A
25	G.E.	650	MD
25	Westg.	825	SK113
20	Westg.	600	M
20	Westg.	750	SK
20	Westg.	975	S-6
20	Western Elec.	1000	E-40-M

D. C. CLARK CONTROLLER

1—250 HP Clark Vari Time magneto controller 230 v. DC reversing, used for plugging service. Can also be used for non-reversing.

MOTOR GENERATOR SETS—
250 & 500 V. D. C.

2—150 KW. 250/275 v. DC 900 rpm. 546 amps. compound wound Ridgeway Generators, direct connected to 1—225 HP. 2200 v. 900 rpm. 3 ph. 60 cy. Ridgeway Synchronous Motors.
1—75 KW. 250 v. DC Westg. type SK Generator direct connected to 220 or 440 v. 3 ph. 60 cy. Induction Motor.
1—33.3 KVA 1800 rpm. gen. dir. conn. to 40 HP 230 v. G.E. Mtr.
1—30 KW 250 v. DC generator direct driven by 46.5 HP 1750 rpm. 220/440 v. 3/60 Westg. Motor.
1—30 KW 250 DC 1150 rpm. Reliance Generator dir. driven by 50 HP 220 or 440 v. 3/60 motor.
2—20 KW 1700 rpm. 250 v. Westg. SK gens. dir. driven by 30 HP 220 or 440 v. 3/60 cy. motors.
1—3 KW 1350 rpm. 250 v. type S Westg. Gen. dir. conn. by coupling to 5 HP 1350 rpm. 110 v. Westg. Mtr.
1—10 KW. 250 v. DC Generator direct driven by 220 or 440 v. 3 ph. 60 cy. motor.

INDUSTRIAL TRUCKS

6 Automatic type LO-5 Low Lift Trucks capacity 5 ton, platform type. Equipped with towing coupler and bumper for pushing cars.
8—New 4 ton Yale & Towne model YSW Multi-Stroke Hand Lift Platform Trucks.

ROTARY CONVERTERS

1—150 KW. 1200 rpm. 300 v. DC, 3 ph. 60 cy. AC Westg. Rotary Converters.
1—300 KW. 600 v. DC 1200 rpm. 3 ph. 60 cy. AC Westg. Rotary Converters.

WRITE, WIRE OR PHONE YOUR ELECTRICAL NEEDS—SEND FOR STOCK LIST, YOUR IDLE EQUIPMENT WITH US

Duquesne Electric & Mfg. Co. Pittsburgh 6, Pa.

MOTORS—M. G. SETS—CONTROL

In Stock—Immediate Shipment—Rebuilt & Guaranteed

230-VDC. CRANE & MILL MOTORS

HP.	Make	Type	RPM.
(1) 2½	G.E.	C.O. 1803 (C.P.)	650
(1) 3	G.E.	C.O. 1803	700
(1) 5	G.E.	M.D. 101	800
(1) 6	G.E.	C.O. 1805	1150
(1) 7½	G.E.	C.O. 1804	725
(3) 7½	Westghse	K-4	750
(1) 7/10	G.E.	M.D. 102 (Bk.Ax.)	1025/800
(1) 9	G.E.	M.D. 102 (C.P.) (Bk.Ax.)	975
(1) 10	G.E.	C.O. 1805	925
(1) 10	G.E.	C.O. 2504	700
(4) 11	Westghse	K-5	700
(5) 14/19	C.W.	B.W. (Bk.Ax.)	675/560
(4) 14/19	C.W.	B.W.	675/560
(2) 15	G.E.	M.D. 406 (A.E.)	725
(1) 15	Westghse	K-5	700
(4) 15	Westghse	MCA-30	600
(1) 21	G.E.	Type 52	345
(1) 20	Westghse	HK-6	650
(1) 25	G.E.	COM-1828 (C.P.)	850
(2) 27½	Westghse	K-7	535
(2) 35	G.E.	CO-2506	650
(1) 30/45	C.W.	D.W.	620/520
(1) 30/45	G.E.	MD-104½ (C.P.)	625/500
(2) 37/30	Westghse	MCA-50	500/550
(1) 40/30	Westghse	MCB-50 (Bk.Ax.)	440/525
(1) 52	Westghse	K-10 (Bk.Ax.)	740
(1) 52	Westghse	K-10	740
(1) 54/80	C.W.	F.W.	575/480
(1) 60	G.E.	MD-105 (C.P.)	550
(4) 65	Westghse	MCB-60 (Bk.Ax.)	425
(1) 65	G.E.	CO-1811 (C.P.	800
(1) 65	G.E.	CO-1811	800
(1) 70/90	Westghse	MCB-70 (Bk.Ax.)	440/400
(2) 85/110	G.E.	MD-107	500/450
(1)	Westghse	MTA-#2 (Bk.Ax.)	

All above series except where C.P. = Compound Wound, (Bk. Ax.) = Back Axle.

MOTOR GENERATOR SETS
1—200 K.W., 250-275 V DC. Allis Chalmers, factory built set with 288 HP. Syn. motor, 80% P.F., 440/3/60 cy. A.C. & D.C. panel, O.C.B. & starting equipment.

VARIABLE SPEED MOTORS 230-VDC.

HP.	Make	Type	RPM.
(1) 3	G.E.	RLC-111 (SH.)	500/1500
(1) 3	G.E.	CR-3	500/1500
(1) 3 (Drip-proof B.B.)	Reliance	14T (SH.)	1200/3000
(1) 5	G.E.	RLC-115 (SH.)	250/1000
(1) 5	G.E.	RF-9 (SH.)	450/1350
(1) 5	Westghse	SK-33 (SH.)	1150/1650
(1) 6	G.E.	RF-9 (SH.)	450/1350
(1) 7½	G.E.	RF-10A (SH.)	450/1350
(1) 7½	Westghse	SK-70	600/1800
(1) 7½	Westghse	SK-70	600/1000
(1) 7½	Westghse	SK-60L (C.P.)	650/1300
(1) 7½	Westghse	SK	850/1700
(1) 8	Westghse	SK-100L (SH.)	300/1200
(1) 8½	G.E.	RF-9 (SH.)	600/1800
(1) 10(115-v.)	Elec. Dy.	7½-S	250/1000
(1) 10	Westghse	SK-80L	800/1600
(1) 10	G.E.	CD	850/1250
(1) 10/15(new)	Allis-Ch.	EB-100 (SH.)	575/1725
(1) 10	Westghse	SK	600/1500
(1) 12	Westghse	SK	600/900
(1) 15	Westghse	SK (SH.)	400/1600
(1) 15	Westghse	SK-100L	450/1500
(1) 15	Reliance	131-T (SH.)	500/1500
(1) 19	Westghse	SK-100L (C.P.)	600/1200
(2) 20	G.E.	RLC	600/1200
(1) 20	G.E.	RLC-702	250-1000
(1) 20	Triumph	Comp.	250/1000
(1) 20	Westghse	SK	650/2200
(1) 25	G.E.	CD-128Y(SH.)	200/800
(1) 25	G.E.	RF-13 (SH.)	400/1200
(1) 25	Reliance	F-3 (C.P.)	500/1500
(1) 30	Westghse	SK-163 (SH.)	400/1200
(1) 35	Westghse	SK-160 (C.P.)	500/750
(1) 45	Reliance	310-T (SH.)	500/1500
(1) 50/60	G.E.	RLC-205 (SH.)	400/1200

2—150 HP., Electro Dynamic Variable Speed, 3-bearing, Frame 75-S, Comp. Interpole, 250/500 RPM., 2 hrs. 185 HP., with Monitor Control Panels, built in Resistance, Auto 4-step acceleration, non reversing, P.B. control.

Constant Speed 230-VDC. Motors

H.P.	Make	Type	RPM.
(2) 2	Al.-Ch.	E-50	1750 SH
(1) 3	Reliance	T-224	3500 SH.
(1) 3	G.E.	CD-55	1150 SH.
(1) 5	Westghse	SK-33	1150 SH.
(2) 5	Westghse	SK-40	850 SH.
(1) 5	G.E.	RC-27A	1150 SH.
(1) 5 (new)	Al.-Ch.	EB-65	1750 SH.
(2) 7½	Westghse	SK-60	850 C.P.
(5) 7½	Westghse	SK-43	1150 SH.
(1) 7½	Westghse	SK-5L	550 C.P.
(1) 7½	Westghse	SK-40 (115-V.)	1150 SH.
(1) 10 (new)	Al.-Ch.	EB-80	1150 SH.
(1) 10	Westghse	SK-50L	1300 SH.
(1) 15	Al.-Ch.	Shunt	800
(1) 15	Westghse	SK-100L	850 SH.
(1) 15	C.W.	CCM	800 C.P.
(2) 20 (new)	Elec. Dy.	182N(Enc.)(B.B.)	1500 C.P.
(1) 25	Westghse	SK-100L	1100 SH.
(1) 30	G.E.	DCL-201	1100 SH.
(1) 35	Westghse	SK-130	850 SH.
(1) 50	Westghse	SK	1700 SH.
(1) 75	Reliance	T	875/1200 C.P.

SLIP RING (CONSTANT DUTY)
220/440-V., 3-PH., 60-CY.

H.P.	Make	Type	RPM.
(1) 3	G.E.	M.Q.-1801 (2-PH)	1080
(2) 7½	G.E.	M.T.-201 (550-V.)	1200
(1) 10	G.E.	I.Q. (2-PH)	1120
(1) 38	G.E.	1-M	1200
(1) 40	Westghse	C.W. (2300-V.)	575
(1) 250	Westghse	C.W.	435
(1) 400	G.E.	M.T.-412	600
(1) 500	Allis-Chal.	A.N.	585
(1) 500	Westghse	C.W. (2200-V.)	360
(1) 600	G.E.	M.T.-412 (2200-V.)	719
(1) 750	G.E.	M.T.-414 (2200-V.)	709

Above two motors with G.E. C.R. 2016 control)

SYNCHRONOUS CONDENSER
1—750 KVA, G.E., type ATI, 600-V., 3-PH., 60-CY. 900-RPM., 8.5 K.W., dir. con. exciter and complete control panel.
Will furnish rewound as 683-HP. Syn. Motor, 440-V., 3-PH. 60-cy.

T. B. MAC CABE COMPANY

4312 CLARISSA STREET — PHILADELPHIA, PENNA.

KIEMLE OFFERS

Rebuilt and Sold with a Standard New Guarantee

IND. FREQUENCY CHANGER SETS

MOTOR GENERATOR SETS
ALTERNATORS, ALL FREQUENCIES
TRANSFORMERS, LARGE STOCK
D.C. GENERATORS, ALL VOLTAGES
CONTROL EQUIPMENT

ALL SIZES
VOLTAGE AND CYCLES

3 ph. 60 cy. A.C. Motors
3 ph. 25 cy. Motors
125 Volts D.C. Motors
230 Volts D.C. Motors
550 Volts D.C. Motors

THE FRED W. KIEMLE CO., 33 N. SUPERIOR ST., TOLEDO 4, OHIO

Put all idle equipment to work. Send your list for prompt action. **WRITE OR WIRE YOUR INQUIRIES**

PUMPS

Rebuilt & Guaranteed

PUMPS—Large stock centrifugal—turbine—piston.

STEAM PUMPS—Duplex - Simplex. Reconditioned and guaranteed.

BOILERS—stacks—Engine Generators—condensers.

LOU COHEN
PUMP & MACHINERY COMPANY
715 Howard St. St. Louis 6, Mo.
Telephone - GArfield 4290

MODERN DIESELS

475 HP Fairbanks Morse 8 cyl. Model 38 1200 rpm, opposed piston type, direct connected 330 KW 250 Volt direct current Generator. Will sell without generator.

120 HP Atlas 6 cyl., 600 rpm, direct connected 75 KW Allis Chalmers 3 phase, 60 cycle, 240 volt generator. Complete and excellent.

Both units in St. Louis stock.

Mississippi Valley Equipment Co.
507 Locust St. St. Louis 1, Mo.

FOR SALE

NON-CONDENSING TURBINE

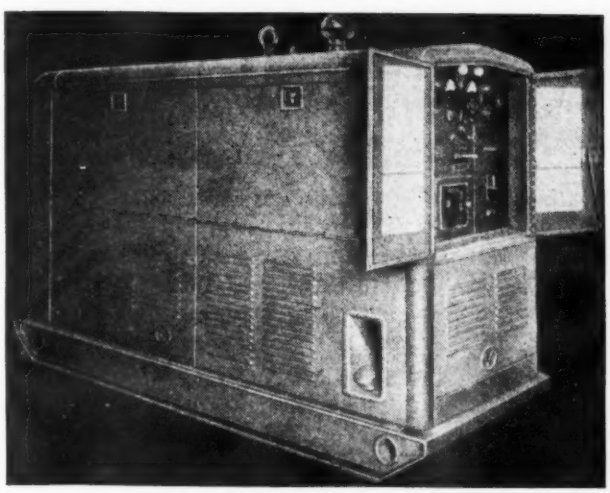
500 KW, nozzled 150#, 10" back pressure. Generator: 550 volt 3 phase 60 cycle 70% P.F.

EXTRACTION TYPE TURBINE

500 KW. General Electric, now nozzled 135# condensing, surface condenser, automatic extraction.
Generator: 550 volt 3 phase 60 cycle.

ANDREN-MYERSON CORP.
411 Atlantic Ave., Boston 10, Mass.

PORTABLE DIESEL GENERATOR SETS



15 KW 30 KW 50 KW
INTERNATIONAL UD-14—UD-18
BRAND NEW—SPOT DELIVERY
RADIATOR COOLED—SKID MOUNTED

60 cycle 127/220 volts
50 cycle 230/400 volts

SPECIAL PURCHASE BARGAIN

ROBERT SCHOONMAKER
Port Washington, Long Island, N. Y.
Phone Roslyn 1600

SLIP RING MOTORS

3-PH., 60 Cy.

HP	Volts	Make	Speed
900	2300	G.E.	900
600	2200	G.E.	720
500	2300	G.E.	900
300	440	Al. Chal.	900
250	2300	G.E.	600
250	440/550	G.E.	600
200	2200/440	G.E.	600
150	2200	G.E.	450
150	2200/440	G.E.	600
150	440/220	G.E.	1200
125	440/220	Whse.	1200
125	440/220	G.E.	1200
125	440/220	G.E. (Hoist)	900
100	440/220	G.E. MTC	900
100	440/220	Whse.	1200
100	440/220	G.E.	1200
80	440/220	G.E. (MTC)	900
75	2200	Al. Chal. (new)	900
75	440/220	G.E. (MTC)	600
75	2200/440	G.E.	1200
50	2200/440	G.E.	600
75	550	G.E.	900
40	2200	Whse.	900

OUTDOOR OIL CIRCUIT BREAKERS

1—New 400 Amp. Type FK, 136-1328A. General Electric, 3PST, 25,000 Volt Oil Switch, Interrupting Capacity 125,000 KVA, complete CT's PT's, etc.

1—3000 ampere, type FK 25, General Electric, 3 pst, 600 volt.

SYNCHRONOUS MOTORS

3-PH., 60 Cy.

500	2200	Al. Ch.		450
300	440/220	G.E.	ATI	600
300	4150/2300	Cr. Wh.	SYN	900
300	2200	Whse.	G	720
300	440/220	Al. Ch.		600
250	4000/2300	G.E.	TS	1200
240	2200	G.E.	ATI	600
200	4150/2300	Whse.	G	1800
200	2200	G.E.	ATI	514
150	4150/2300	Whse.	G	1800
110	440/220	G.E.	TS	1800
100	440/220 25 cy.	G.E.	TS	375

TRANSFORMERS

60 Cycle

3— 833 kva. Whse., 11000-2300 V.
1— 300 kva., Whse., 3 Ph., 13800-230 V.
3— 250 kva., Whse., 13,800-460.
3— 100 kva., G.E., type H 2400-240-480.
3— 100 kva., G.E., type H-KDD, 6900/11950V-230/

SQUIRREL CAGE MOTORS

HP	Volts	Make	Type	Speed
500	440/220	G	IK	1200
500	440/220	G.E.	IK	900
400	2200/440	Whse.	CS	720
400	2200/440	G.E.		600
400	550	G.E.	IK	720
350	440	G.E.	IK	900
200	440/220	Whse.		1200
200	2200	G.E.		1800
200	440/220	Wagner	RP	1800
200	2200/550	Al. Ch.	AR	900
150	2200/550	Al. Ch.	AR	1800
150(3)	440/220	G.E.	KT	1200
125	2200	G.E.	KT	900
100	440	G.E.	IK	450
100	2200	G.E.	KT	1800
100	440	Whse.	CS	1200
74	2200	G.E.	KT	900
50	2200	Al. Ch.		720

MOTOR GENERATOR SETS

1—100 kw, 250 v., 900 rpm, Whse., conn. to 150 hp, 2300 v., 60 cy., sq. cage motor
1—60 kw, 250 v., 1200 rpm, G. E., conn. to 90 hp, 440/200 v., 60 cy., syn. motor
1—60 kw, 125 v., 1200 rpm, Whse., conn. to 75 hp, 440/220 v., 60 cy., syn. motor.
1—35 KW, 125 V., 1800 RPM., G.E., conn. to 50 HP., 440/220 V., 60 cy., squirrel cage.

A.C. GENERATORS

1—300 kva, 600 rpm, 440/220 v., G. E.
1—225 kva, 600 rpm, 440/220 v., G. E.
1—190 kva, 514 rpm, 2200/440 v., G. E.
1—150 kva, 900 rpm, 440/220 v., G. E.
1— 98 kva, 1800 rpm, 440/220 v., G. E.
1— 96 kva, 360 rpm, 480/240 V. G.E.

STEPHEN HALL & CO.

HARRY J. RICE PRES.

458 SEVENTH ST. HOBOKEN, N. J.

WE NEED the following DIESELS!

either new or reconditioned

For Marine Propulsion:

1—1000 to 1100 HP, or twins 500/600; 600/800 RPM; with reduction gears 1:2 or 1:2.5. Max. weight 25 tons for single unit or combined for twins.

1—2000 to 2700 BHP, or twins 1100 to 1350/1400 BHP; 110/160 RPM

1—set, twin engines, 500 HP, lowest possible RPM

4—1400 HP each, lowest possible RPM

1—approximately 450 HP

1—1800 HP; 750/800 RPM; 2 or 4 cycle; single action; reduction gears to screw speed of 250 RPM.

1—3000 BHP; low RPM.

Submit prices and deliveries.

ARNESSEN ELECTRIC COMPANY

116 BROAD STREET, NEW YORK, N. Y.

Complete Power Plant

USED

Excellent Operating Condition

2—72" x 18' Tudor boilers horizontal tube with Detroit underfeed stokers operating with 150# PSI with all auxiliary equipment. 4 feet x 90 feet stack.

1—Skinner Engine 20 x 22 right hand center crank. Universal Uniflow engine connected direct to 200 KW 230 volts DC General Electric generator 200 RPM.

1—Skinner Engine 13 x 15 left hand center crank counterflow type connected direct to 100 KW 230 volts DC Triumph Electric Generator 250 RPM.

1—Direct current Balancer set.

1—Multi-section open face slate distributing control panel.

SET UP IN OPERATING CONDITION.

Open for inspection.

Inviting bids for all or part.

THE E. W. BUSCHMAN COMPANY INC.

Clifton and Spring Grove Avenues

Cincinnati 32, Ohio

POWER PLANT EQUIPMENT CO., INC.

39 Cortlandt Street
New York, N. Y.

A.C. TURBINE UNITS

6250 KVA GE 2300 v., cond.
3125 KVA GE 2300 v., 300#, cond.
1500 KVA Wghse. 480 v., (bleeder)
1250 KVA GE 2300 v., cond.
1250 KVA Al. Chal. 480 v., non-cond.
750 KVA GE 2300 v., 250#
625 KVA Wghse. 480 v. (bleeder)
625 KVA Al. Chal. 2300 v., 85# B.P.
625 KVA Elliott 480 v., non-cond.
312 KVA GE-Moore, 450#
250 KVA GE, non-cond.
187 KVA GE, non-cond.
125 KVA CW-Moore, non-cond.
110 KVA Al. Chal.-Elliott, non-cond.
50 KVA GE-Terry, non-cond.

ENGINE UNITS (UNIFLOW)

750 KVA GE-Chuse
625 KVA GE-Skinner
350 KVA GE-Ames

DIESEL UNITS

312 KVA (2) GE-Anderson
225 KVA Wghse.-Worthington
150 KVA FM-FM
125 KVA GE-Worthington
118 KVA (2) GE-Winton
90 KVA Ideal-Worthington
65 KVA FM-FM

ROTARIES, & M. G. SETS

2600 KW (2) GE, 250 v. Rotaries
150 KW GE 250 v.-440 v. Syn. Motor

SYN. CONDENSER

3000 KVA Al. Chal. 3-60-2300 v.

MOTORS

2100 KVA (2) GE 4600 v. Syn., 514 RPM
600 HP Al. Chal., slip ring, 2200 v., 585 RPM
400 HP Wghse., slip ring, 2300 v., 435 RPM
200 HP FM syn., 2300 v., 600 RPM

MISCELLANEOUS

24 x 42 Corliss Engine
Two 200 KW 250 v. 3 wire; Ames Vertical-Ames ver. unit.

BOILERS

12—30,000# Foster Wheeler 475# pressure boilers with oil burners, 1942.
2—600 HP Springfield Sectional Headers, 200# pressure, rebuilt.
3—768 HP Stirling Boilers, 200# pressure.
1—256 HP Stirling Boiler, 160# pressure, new tubes, stoker.

TURBINES

2—5000 KW Westinghouse 3600 RPM 3/60/2300 volts Condenser, all auxiliaries.
2—15,625 KVA General Electric Condensing Turbines.
1—3700 KVA General Electric Condensing Turbine.
1—300 KVA General Electric Condensing Turbine.

DIESEL ENGINES

3—300 KVA Fairbanks-Morse Full Diesel Engines.
3—200 KVA Fairbanks-Morse Full Diesel Engines.
1—350 KW Burch Sulzer 3-60-2300 Volt, all auxiliaries.
2—300 KVA Fairbanks Morse Full Diesel Engines.
1260 KVA Nelesco engine generator.

ENGINE GENERATOR SETS

1—750 KVA Corliss Engine Generator Set.
1—565 KVA Skinner Uniflow Engine Generator.
1—375 KVA Harrisburg Uniflow Engine.
1—150 KW Skinner Uniflow Engine Generator Set A.C.
1—600 KW Skinner Vertical A.C. Generator.
1—500 KW Non Releasing Corliss, 3-60-240 volts.

MISCELLANEOUS

90,000# Cochran deaerating feed water heater.

2500 HP Cochrane Open Feed Water Heater.

1—10' x 15' Illinois Forced Draft Chain Grate Stoker.

1—110,000# Cochrane Deaerating Heater.

2—300 HP Westinghouse Underfeed Stokers, rebuilt.

2—150 HP Canton Ram-fed Stokers.

2—75 HP Elliott Geared 900 rpm turbines 385# steam pressure.

1—232 GPM Centrifugal Boiler Feed Pump, turbine driven, 1200 ft. head.

SEE Fletcher FIRST!

FLETCHER SALES CO.
325 Fincastle Building LOUISVILLE, KY.

DIESELS

New 15 HP HILL Model 2R Diesel Power Units 2 Cylinder, 1500 RPM, includes: Radiator, Spare Parts, Battery, etc.

New 75 HP CHRYSLER Diesel Power Units, 6 Cyl., Model IND-10, 4 Batteries, Radiator, Fuel Tank, Tool Kit, Silencer.

8—used Hercules Diesel Engines, Model DFXDF, 175 HP, direct coupled to: 85 KW General Electric variable voltage DC Generators.

5—used Buda Diesel Stationary Power Units, 125 HP at 1200 RPM, Model 6 DHG691.

ALJON ELECTRIC DIESEL CO.
904-10 Pacific Street Brooklyn 16, N. Y.
Sterling 3-6515

1—26"x32" Chuse Uniflow Engine, Serial No. 3005, direct connected to 500 KVA 2300 volt, 3 phase, 60 cycle Alternator, Serial No. 4340124 and shaft mounted Exciter, complete with accessory equipment. Price will be given bare or installed upon request.

3—1000 KVA, 13,200 to 480 volt Allis-Chalmers Transformers, water cooled, Serial Nos. 1510609, 10 and 11. With 3 taps below 13,200.

PORTER ELECTRIC COMPANY, Inc.
330 S. 6th St., MINNEAPOLIS 15, MINN.
Geneva 8655
ELECTRICAL EQUIPMENT COAST TO COAST

FOR SALE

Triplex Pumps

Deming 6" x 8", 160 G.P.M., 150#
Goulds 4" x 6", 60 G.P.M., 150#
Fitzhenry-Guptal, 4" x 4", 40 G.P.M., 150#
ATLANTIC PUMP & SUPPLY CO., INC.
5-7 Steeple Street Providence, R. I.

FOR SALE

New and guaranteed used steel pipe in large quantities up to 36" inclusive, also, new and guaranteed used boiler tubing, steel buildings, steel and wood tanks, valves, fittings and pumps.

Jos. Greenspon's Son Pipe Corp.
NATIONAL STOCK YARDS
St. Clair County, Illinois

STEAM PUMPING ENGINES

1—Snow 8MGD C&FW cr. Com. Opp. Type Cond. 26x54x17x36, with waterworks type condenser.
1—Snow 6 mgd. C&FW Cr. Com. Opp. Type Cond. 20x40x14½x36 with waterworks type con.
1—Allis-Chal. 4 mgd. cr. com. cond. Size 12x28x13x24. All find cond.
1—Worth Cr. Comp. Cr. & Fly wheel LDG Meyer Valve gear, 1 MGD, size 10/20x7½x18.

PUMP VALVES

Birch Valves for all types of reciprocating pumps.

BIRCH MANUFACTURING COMPANY
1523 Sedgwick St. Chicago 10, Ill.

BRONZE IRON **PUMPS** ALLOY METALS
ELECTRIC—STEAM—GASOLINE DRIVEN.
All Makes — Capacities — Pressures.
Centrifugal — Rotary — Plunger — Turbine.

MOTORS 1-2-3 PH. & D. C.
STANDARD EQUIPMENT — UP TO 200 H.P.
Generators — Welders — Dynamos.
New & Rebuilt Guaranteed Machines.

TURBO BLOWERS
SPENCER—INGERSOLL RAND—ALLEN
BILLMYRE. For Heat Treating — Brazing
Furnaces — Smelting — Vacuum Duty Etc.

TURBINE PUMP
BOILER FEED
VERTICAL ENGINE
VACUUM RETURN
STEAM UNITS

AIR COMPRESSORS
ALL TYPES—CAPACITIES 1 to 1000 "CFM"
Electric — Gasoline — Steam Driven.
For Industrial — Mine Construction.

VACUUM UNITS
FOR STEAM — AIR — GAS — FLUIDS.
All Makes — All Capacities — Tested.

FANS—EXHAUSTERS
CAPACITIES FROM 25 to 100000 CFM.
VENTILATING — SUCTION — BLOWING
Air — Dust — Gases — Steam Vapors.

MACHINERY
CHEMICAL & INDUSTRIAL EQUIPMENT.
ELECTRIC MIXERS—PORTABLE & STATIONARY.

SUPERIOR EQUIPMENT CO.
138 Grand St., N. Y. C. Tel. CAnal 6-6983-4

FOR SALE
1—160 HP, reset 180#, Heine Boiler
2—72x18, 140# reset, HRT Boilers
1—250 & 600 HP Slip Ring Motors
1—625 KVA Westge. Turbo Gen. Set
150—4200 Gal. Brand New Vertical Tanks
1—60,000 & 40,000 Gal. Tanks & Towers
1—75 HP 220-440 V. 1800 RPM Motor
H. & P. MACHINERY CO.,
6719 Etzel Ave., St. Louis 14, Mo.

MURRAY BOILER

300 HP Single long drum straight tube 180#, 100° superheat. Code. Full trim, Diamond soot blower. Crane nonreturn valve. Copes regulator. Taylor underfeed stoker. Offer at bargain.

F. W. HAY & COMPANY
2734 Cherry St. Kansas City 8, Mo.

200, 140, 125, 100 KW AC UNIFLOW SETS
200, 50 KW DC UNIFLOW SETS
Turbo, Water Wheel gen. sets, boilers
150 ton Ice Machine. Uniflow drive
1500 HP Cochrane Lea V epen heater
80, 60, 25, 15 HP DC 115V. motors
60 HP Ideal 3/60-440 V. 720 RPM SC.
M.G. Sets, Transformers, pumps etc.
JAS. K. HOOPER
50 CHURCH ST., New York City 7

THESE AND OTHERS AVAILABLE FROM STOCK

NEW MOTORS

Squirrel Cage—3 Phase, 60 Cycle

Qu.	H.P.	Volts	R.P.M
4	1	220/440	3450
2	1½	220/440	3450
3	2	220/440	3450

Reconditioned & Guaranteed MOTORS

Squirrel Cage—3 Phase, 60 Cycle

Qu.	H.P.	Make	Volts	R.P.M.
2	25/19	G.E	440	1200/1900
1	20	Lincoln	220	1800
1	25	Imperial	440	900
2	30	Al. Ch.	440	900
1	35	Al. Ch.	440	720
2	40	West.	220	720
1	40	Imperial	440	900
1	50	Burke	2200	900
2	50	Al. Ch.	440	1800
1	100	Al. Ch.	550	900
1	100	West.	220	600
1	150	Al. Ch.	440	1750

Slip Ring—3 Phase, 60 Cycle

Qu.	H.P.	Make	Volts	R.P.M.
1	15	Imperial	440	1150
1	15	Triumph	440	860
	25	West.	440	1150

Synchronous

Qu.	H.P.	Make	Volts	R.P.M.
1	50	Ideal	2200	600
1	150	Al. Ch.	240	277
1	150	El. Mchy.	220/440	1200

D.C. Adjustable Speed

75—From 1 to 150 H.P., 230 and 115 volts.

Misc. Electrical Equipment

10—Reconditioned Lincoln Welders, 200 Amp., 220 volts, 3 phase, 60 cycle.

15—New Harnischfeger Electric Hoists, ½ to 2 ton capacity, 220/440 volts, 3 phase, 60 cycle.

ELECTRIC MOTOR & REPAIR CO.
Division of A-C Supply Co.
1745 FRONT ST. CUYAHOGA FALLS, OHIO

DIESEL ENGINES
FOR SALE

1—60 HP Chicago Pneumatic, horizontal, semi.

1—75 HP F-M full diesel.

2—100 HP F-M, 2 cylinder, vertical, semi.

1—200 HP Worthington, 4 cylinder, full diesel.

Several with
A.C. Generators, 240/480 volts.

We buy and sell all types of Pumps, Compressors, Boilers, Processing Equipment and Conveyors.

LOU COHEN
PUMP & MACHINERY CO.
715 Howard Street St. Louis 6, Missouri
Telephone: GArfield 4290

TRANSFORMERS

3—883 Kva—2400—240/120

2—400 Kva. Pittsburgh, 25 cy. 1 ph. 6600—440/460

3—150 Kva. Westinghouse, 60 cy, 1 ph. 13200—440

6—75 Kva—2300—230/115

6—50 Kva—2300—230/115

New or used. All types and sizes

ATLANTIC TRANSFORMER CO.
TRANSFORMER SPECIALTIES
5143 N. 2nd St. Philadelphia, Pa.

1—Westinghouse Voltage Regulator Transformer 69 KVA Serial No. 2623894

1—Ditto Serial No. 2623895

1—Westinghouse Double Flow Turbo-Generator 2500 KVA

1—Terry Turbo-Generator 625 KVA

1—General Electric 500 K.W. Generator

FS-139, Power
330 West 42nd St., New York 18, N. Y.

187 K.V.A. ENG. SET.

480 V. 60 cy. 3 ph. 225 Rev. GE. Eng. 18"x21" 4 Valve, Exciter Etc.

ROSS POWER EQUIP. CO. Indianapolis Ind.

FOR SALE

DIESEL ENGINE

1—Vertical Diesel Engine Type D4 300 HP 4 Cylinder, direct connected to General Electric Type LDR-8 direct current Generator 200 KW 327 RPM L 250 V.

EXHAUST TEMPERATURE INDICATOR

1—Alnor Exhaust Temperature Indicator with 4-point switch and 4 couples Mfd. by Worthington Pump and Machinery Corp. Mfrs. No. V0862. Installed 1933. In excellent condition and is in operation now.

The Frank Tea & Spice Company
Cincinnati 2, Ohio

TURBINE UNIT

1—2500 KVA, Westinghouse, 3 ph., 60 cy. 460 V. 3600 RPM turbo unit, with direct connected exciter, surface condenser and auxiliaries.

Priced Attractively for Quick Sale

BREW, WOLTMAN & CO., INC.
50 Church St., New York 7, N. Y.

FOR SALE

TRANSFORMERS

"Government termination 27 Westinghouse Elec. Single Phase Transformer AKV—3—Oil"

WINDING VOLTS

High	6000
	5850
	5700
	5550
	5400
Low	240

LOWENSTEIN BROS. INC.
71-87 Boyd St. Newark 3, N. J.

FOR SALE

1 Hamilton-Corliss Engine #3066, 16x30 E. Right Hand, 110 lbs. initial steam pressure. Atmospheric exhaust, 110 R.P.M., 180 I.H.P. at 25% cut off, 26 lbs. steam per I.H.P. hour. Good condition.

THE WRENN PAPER COMPANY
Middletown, Ohio

DIESEL ENGINES
GENERATORS AND BOILERS

2—Nordberg Diesel Engines; 525 H.P. 225 R.P.M. directly connected to 340 K.W.; 240 volt DC; Elliott Generators; and 550 cu. ft. Nordberg High Efficiency Air Compressors.

1—Cummins Diesel Engine; 50 H.P.; 625 R.P.M. directly connected to 30 K.W.; 240 volt DC; Westinghouse Generator and Winton Model 118 Air Compressor; 20 cu. ft. per minute against 1000 lb. pressure.

2—Scotch Marine Boilers; 400 H.P.; 180 lb. steam pressure. All sizes steam pumps.

Numerous motor driven centrifugal pumps and winches.

LIBERTY INDUSTRIAL SALVAGE CO.
BOAT BREAKING DIVISION
P. O. Box 545 - Blakely Island - Tel. 3-1640
Mobile, Alabama

REBUILT TRANSFORMERS
OIL COOLED — SINGLE PHASE
60 CYCLE — WITH TAPS

3—2000 KVA GE 13200/26000 to 2300 V.
3—667 KVA Packard 23000 to 460/230 V.
2—600 KVA Whse. 3 Ph., 2300 to 440 V.
1—1200 KVA Whse. 3 Ph., 6600Y to 2300 V.
1—15,000 Pitts. 3 Ph., 27880 to 4560 Y V.
4—3333 KVA GE 25/60 cy. 60000/ to 4000/6925Y/8000/13850 water and oil cooled
100—50 KVA Whse. 13200/110/220 V.
3—750 KVA GE 13200/2300 V.

Philadelphia Transformer Co.
2829 Cedar St. Philadelphia, Pa.

— BOILERS —

2—Modern 400 lbs. Code Watertube Boilers. Evaporation rate up to 33,462 lbs. per hr. with valves and fittings. Like new.

4—400 HP, B & W 167 lbs. Longitudinal Drum Boilers with structural and Dutch oven frame work, bricking and valves.

9—Brand new 200 lbs. to 450 lbs. Combustion Engineering Boilers. Generates up to 44,436 lbs. steam per hr. actual. With oil burners and modern automatic features.

2—150 HP Scotch Marine Double Furnace Boilers—retubed.

1—125 HP, 175 lbs. Wash. Iron Works Vertical Extended Firebox Boiler.

1—65 HP Lidgerwood 200 lbs. Code Vertical Round Boiler.

Subject to prior sale

Sundfelt Equipment Company
3422 First Ave. South, Seattle 4, Wash.
MAin 1474

1800' Air Compressors

2—Sullivan type WN-31 air compressors, angle compound, 2 stage, direct connected to General Electric 300 H.P. synchronous motors, exciters, control panels, after-coolers, air receivers, etc.

New 1943 **Immediate Delivery**

Other sizes of late type machines available

DENNY & CLARK
910 N. Marshfield Ave. Chicago, 22, Ill.

VALVES

INDUSTRIAL & MARINE

METROPOLITAN
PLUMBING SUPPLY CO., INC.
Power Plant Valves and Engineering Specialties for Oil, Steam, Gas, Air, Liquids and Chemicals.
Jenkins, Fairbanks, Sarco, Powell Valves and surplus.
Large Complete Stocks ⅛" to 24"
313 E. 31st., NEW YORK CITY
For Hourly Nationwide Shipments
Call MUrray Hill 3-3406

SKETCH PIPE & FITTINGS

BOILER

250-hp Babcock-Wilcox horizontal water tube boiler, 42 inches x 11 feet 6 inches, riveted steel drum; 130 four-inch tubes; 150-lb. working pressure. Fully equipped with Riley-Jones type S.P. side-dump hopper feed stoker, low water control and draft gauge. Installation includes 100-foot steel stack, 36-inches in diameter car-to-bin and bin-to stoker conveyors as well as all necessary electrical equipment for complete operation.

All in excellent working condition. Having installed gas-oil boilers, we will sell as-is, where-is, at attractive price.

SHOPPING NEWS
5309 Hamilton Ave., Cleveland 14, Ohio

MOTORS For Sale

1—GE 10 HP 1800 RPM 3 Phase 550 Volt 60 Cycle Type K324 Ball Bearing.
4—Crocker Wheeler Gear Head ¾ HP 350 RPM 550 Volt 3 Phase 60 Cycle.

Other Sizes & Voltages Available

FLUSHING ELECTRIC CORP.
45-06 162 St. Flushing, N. Y.

THE GLOW ELECTRIC COMPANY

933-943 HARRIET ST. Phone MA. 3024 CINCINNATI 3, OHIO

Solicits your inquiries for

STEAM ENGINE-GENERATOR SETS

Westinghouse, type SK, 9½ KW, 675 RPM, 125 Volt, Direct Current, Generator, driven by twin cylinder vertical steam engine

General Electric, 40 KW, 300 RPM, 125 Volt, Direct Current Generator, driven by Skinner 9" x 12" Steam Engine

Burke, 50 KW, 300 RPM, 125 volt, Direct Current Generator, driven by Skinner 11" x 12" Steam Engine

Ridgeway, 35 KVA, 30 KW, 8 Power Factor, 300 RPM, 2300 Volt, 3 ph., 60 cy., driven by 10" x 10" Ridgeway Steeam Engine

Westinghouse, 75 KW, 125/250 Volt, 275 RPM, Direct Current Generator, driven by Chuse Steam Engine 13½" x 14"

Westinghouse, 125 KW, 125 volt, 250 RPM, Direct Current Generator, driven by Skinner Steam Engine 15" x 16"

General Electric, 200 KW, 125 Volt, 210 RPM, Direct Current Generator, driven by Skinner tandem compound 15 x 25 x 20"

Westinghouse, 200 KW, 125 volt, 200 RPM, Direct Current Generator, driven by Ames horizontal Steam Engine

Triumph, 200 KW, 125 volt, 150 RPM, Direct Current Generator, driven by Rice & Sargent Steam Engine 16 x 36"

Triumph, 300 KW, 125 volt, 125 RPM, Direct Current Generator, driven by Rice & Sargent Steam Engine 22" x 36"

DIESELS

Cummins, 50 HP, 600 RPM, 4 cylinders, vertical, Model F

Fairbanks-Morse, 50 HP, 257 RPM, single cylinder, vertical, style V

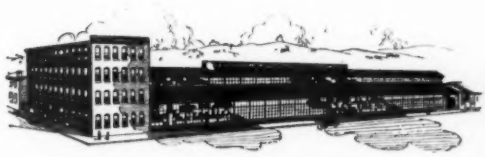
Winton, 57 HP, 425 RPM, 3 cylinder, vertical, model 67

Buckeye, 65 HP, 290 RPM, horizontal, Semi-Diesel

SPECIAL

G. E. Motor Generator Set for Mill Drive complete with driving motor, G. E., type MCF, 500 KW, 550 volt, 900 RPM, D.C. generator driven by G. E., type ATI, 510 HP, .95 P.F., 900 RPM, 2300 volt, 3 ph., 60 cy., synchronous motor with direct connected exciter
Driving motor, G. E., type MPC, 675 HP, 400 RPM, 550 Volt, pedestal bearing, interpole

IN BUSINESS SINCE 1905



COMPLETE POWER PLANTS

STEAM—ELECTRIC—HYDRO—DIESEL
"Export Orders Carefully Executed"

SPECIAL OFFERING

Several 450# and 600# boilers available
2—1400 H.P. B. & W. 225-lb. Boilers
2—1060 H.P. Heine Boilers 200#
2— 825 H.P. B. & W. Sterling Boilers 200#
2— 770 H.P. B. & W. Sterling Boilers 185#
2— 600 H.P. B. & W. 200# Boilers
2— 600 H.P. Edge Moor 200# Stokers
2— 440 H.P. B. & W. Sectional 200# Oil Fired
4— 500 H.P. Heine 200 lb. Boilers
Smaller Boilers and Fire Tube Boilers also

Several 425# and 550# Turbo-Generators available
20,000 KW GE Co. turbo-generators condensers
2—12500 K.W., G.E. Co., Turbo-Generator Condensing
1— 5000 K.W., G.E. Co., Turbo-Generator Condensing
3— 4000 K.W., G.E. Co., Turbo-Generator Condensing
2— 2500 K.W., G.E. Co., Turbo-Generator Condensing
2— 2000 K.W., G.E. Co., Turbo-Generator Condensing
1— 2000 K.W., W. E. & M. Co., Turbo-Generator Con.
2— 1000 K.W., G.E. Co., Turbo-Generator Condensing
2— 750 K.W., G.E. Co., Turbo-Generator Condensing
Several 500 KWs. & Smaller Units.

Non Condensing Turbos—300—500—750—and 1000 K. W. & Larger

CHARLES B. REARICK **30 CHURCH ST.** **NEW YORK**

POWER EQUIPMENT COMPANY

OIL—AIR CIRCUIT BREAKERS

4—500 A GE FK 12 3 PST 15,000 V. Handle. Trip Coils and Currents.
1—800 A Condult E4 600 V. 3 PST Handle. Trip Coils and Currents.
1—1200 A. GE FK 132 A 3 PST 7500 Handle with Trip Coils and Current Transformer.
1—2000 A GE CK 3 Air Breaker 3 PST 600 V. O. I. & U.V.
1—3000 A GE FR 25 Oil Breaker 3 PST 600 V. Solenoid operated with currents.

Sq. Cage—220/440 V. 60 Cy. 3 ph.

Qu.	HP	Make	Type	Speed
2	50	G.E.	KT-327	1800
2	100	G.E.	1K	1800
1	150	West.	CS	1800

Slip Ring—220/440 V. 60 Cy. 3 ph.

1	40	West.	CW	720
1	50	G.E.	I-M	900
1	60	G.E.	I-M	900
1	75	West.	CW	900
1	250	West.	CW	1200

D. C. Variable Speed 230 V.

1	15	West.	SK	400/1600
1	25	West.	SK	440/1200
1	50	West.	SK	500/1500
1	50	G.E.	CD	400/1600

SEVERAL HUNDRED OTHER ITEMS IN STOCK
ABOVE ONLY SPECIALS—ALL REBUILT—STOCK SHIPMENTS

373 S. GOODMAN ST. **Hillside 2041** **ROCHESTER 7, NEW YORK**

SEARCHLIGHT SECTION

Cash Ready

FOR YOUR

ELECTRICAL EQUIPMENT

Electric motors, AC and DC
Compensators
Generators
Motor Generator Sets
Air and Oil Circuit Breakers
Panels
Exhaust Fans
Control Equipment

Send us list with full details

WIRE OR PHONE
P. O. Box 534

POWER EQUIPMENT CO.
373 SO. GOODMAN ST., ROCHESTER 7, N. Y.
Phone Hillside 2041

WANTED

2—300 H.P. Boilers with stokers in exchange for

2—600 H.P. Springfield Crossdrum Boilers complete with Harrington stokers, including steel structure, soot blowers, superheaters, forced draft fan and vertical reciprocating steam engine 8x8. Approved for 200# working pressure. Completely dismantled ready for immediate shipment.

MIDWEST MFG. COMPANY
Galesburg, Illinois

WANTED

One or two NRC or Uniflow Engine generators, 3 phase, 60 cycle, 230 volts, capacity 250 to 500 KVA, non-condensing, 135# steam pressure, 5# back pressure.

W-177, Power
520 North Michigan Ave., Chicago 11, Ill.

WANTED TO BUY

One (1) 125 HP. Boiler and Stack. Must pass insurance for 150 pound working pressure.

CRYSTAL ICE WORKS, INC.
P. O. Box 98 Bartow, Fla.

WANTED

Two D.C. MOTORS

TYPE MPC, CLASS 6—150 H.P. 500, Form A, 500 R.P.M. 250 Volts, General Electric—150 H.P.

W-978, Power
330 West 42nd St., New York 18, N. Y.

WANTED

Centrifugal Pump

6" Suction, 5" discharge 169 T.D.H. direct connected to 440 Volt Motor A.C.

P. O. Box 246, Waltham, Mass.

WANTED

CATALOGS

General Catalogs of Westinghouse Co. years 1923—1924 and 1933 to 1938 inclusive. Also General Electric Co., from 1922 to 1929 inclusive.

W-157, Power
330 West 42nd St., New York 18, N. Y.

WANTED

1000 k.w. Condensing Turbine,

3 phase, 60 cycle, 3600 r.p.m., direct connected exciter, complete with condenser pump and auxiliaries, interconnecting pipes, switchboard and instruments. Specify all details as to age, length of service, and submit drawings.

SECURITY MILLS, INC.
Box B
Newton 58, Mass.

WANTED

2000 k. w. Condensing Turbine

3 phase, 60 cycles, 200# pressure, 23-2400 volts, complete with condenser and auxiliaries, switch board and instruments. Specify all details as to age, stages, length of service, etc., location and price.

HOPE WATER & LIGHT PLANT
Hope, Arkansas

WANTED

Electrical Equipment

1—10,000 KVA—Transformer—66/13.8 K.V.
1—400 Amp.—66 KV—3 pole horn gap switch.
3—200 Amp.—66KV—Fuses and Holders.
400-800 Ft.—250—500 MCM, 3 Cond., 23 KV Cable.
3—66 KV Lightning Arrestors.

Contact Purchasing Agent

Pittsburgh Plate Glass Company
New Martinsville, W. Va.

WANTED

One or more larger vertical natural gas engine generating units up to 1000 KW, 3/60/2300. Give full particulars with condition and best price.

PENN MACHINERY COMPANY
Jackson, Miss.

WANTED

Several 300 KW—720 RPM

AC Generators

P. O. Box 232, Port Washington, L.I., N.Y.
Phone Roslyn 813.

WE NEED MOTORS!

1—½ HP—Single Phase
1750 R.P.M.—Ball Bearing

One or more—any quantity—any make! *Wire collect, quoting price and quantity.*

KENT ENGINEERING COMPANY
3000 Hyde Park Boulevard, Los Angeles, California

Air Compressors Wanted

Horizontal Water Cooled—Any size also 2 Stage portable units

L. W. BAUER
North Bergen, N. J.

SALESMAN

Long established and progressive manufacturer of Boiler Water Treatment and Kindred Products has money-making opportunities in the Midwest, South and East for aggressive salesmen—exclusive territories—liberal commissions—send full details, selling experience, etc., to

SW-166, Power
330 West 42nd St., New York 18, N. Y.

SALES ENGINEERS!

With mechanical or chemical engineering background. Excellent opportunity for hard workers with real sales ability in key locations all over the United States. We are well known manufacturers of nationally advertised chemicals for the scientific conditioning of industrial water—car essential; experience in this line unnecessary—our organization knows about this advertisement. Write fully age, education, sales experience, salary requirements.

SW-167, Power
330 West 42nd St., New York 18, N. Y.

DIVISIONAL SALES MANAGER

Desired by nationally known manufacturer of electrical and mechanical control equipment for industrial applications. Technical sales background required. Salary plus commission. In reply give full details.

SW-161, Power
68 Post Street, San Francisco 4, Calif.

SALES MANAGER

with mechanical or chemical engineering background. Must have proven record in sales management and must be capable of building up an aggressive sales organization in the Chicago territory. We are well known manufacturers of chemicals for the scientific conditioning of industrial water. Write fully education, experience, salary requirements.

SW-172, Power
330 West 42nd St., New York 18, N. Y.

We are principals acting in our own behalf willing to

PAY YOU IMMEDIATE CASH

FOR ASSETS or CAPITAL STOCK of . . .

- **INDUSTRIAL PLANTS**
- **MFG. DIVISIONS or UNITS**

All transactions held in strictest confidence.
Personnel retained wherever possible.
Address: Box 1234, 147 W. 42 St., New York 18, N.Y.

IF THIS—OR ANY—ISSUE OF POWER DOES NOT CONTAIN

The Information You Want

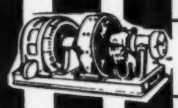
ABOUT PRODUCTS, SPECIALTIES OR SERVICES, PLEASE WRITE:

POWER

BENJAMIN

NEW • ELECTRIC • STEAM • AIR EQUIPMENT
Thousands of Items A/C or D/C from 1 to 500 K.W.

WIRE, MAIL, or PHONE
Your Requirements



USED EQUIPMENT
Thoroughly Overhauled, Tested & Approved AND GUARANTEED for 1 full year

Agents for:
CROCKER-WHEELER
U. S. ELECTRIC TOOL CO.
WESTINGHOUSE AIR BRAKE
"SCHRAMM" and others

BENJAMIN'S RELYABILT EQUIPMENT

Benjamin's for Motors
ESTABLISHED 1904

130 CLINTON STREET ★ BROOKLYN, N. Y. Windsor 5-1700

Thousands of Items - A/C or D/C. From 1 to 500 KW

NEW GENERATORS

Leland, 2.5 KVA, 120-volt, 1800 RPM, 60-cycle, single phase, self excited AC Generators, 1 bearing.

Clark Elec. 7½ KW, 120-volt, 1800 RPM, single phase, 1 bearing AC Generator complete with voltage regulator.

Clark Elec. 15 KW, 120-volt, 1800 RPM, 60-cycle, 1 phase, 1 bearing AC Generators complete with voltage regulators.

* * * * *

3 KW gasoline engine driven generator units.

Carson Machine & Supply Company
Oklahoma City Oklahoma

OVERHEAD CRANES

1-Ton
Whiting 33' Span
Curtis 24' Span
1½-Ton
Shepard Niles 25'6" Span
P&H 34' Span
2-Ton
Louden 19'2" Span
Box 36'9" Span
Detroit 28' Span
3-Ton
Shaw 33' Span
P&H 25' Span
Northern 22' Span
Manning, Maxwell & Moore 48'5¾"
"Conco" 48' and 26'6" Spans
5-Ton
Whiting 47'4" Span
38'10½" Span D. C.
Northern 30'9" Span
Milwaukee 70' Span
Milwaukee 66'9" Span
Manning, Maxwell, & Moore 79' Span
Manning, Maxwell, & Moore 47'4" Span
Shaw 36' Span
Champion 37'6" Span
American 70' Span
American 47'4" Span
6-Ton
P&H 77' Span
American 77' Span
7½-Ton
Shepard 36' Span
10-Ton
Shaw 68' Span
Shaw 73' Span
P&H 30' Span
P&H 87'6" Span
P&H 80' Span
Northern 71'10½" Span
Northern 60' Span
Morgan 55'6" Span
Morgan 39'5" Span
Morgan 52'3" Span
Milwaukee 66'9" Span
McGill 85' Span
Lane 50' Span
Ensco 75' Span
Dominion 35' Span
Cleveland 38'1½" Span
Cleveland 50' Span
Alliance 71'10½" Span
Alliance 58'9" Span
Albany 60' Span
15-Ton
Whiting 71'10½" Span
Northern 53' Span
Erie 60' Span
Chesapeake 55'6" Span
Case 51' Span
20-Ton
Shepard Niles 49'6" Span
P&H 51'4" Span
Northern 60' Span
Morgan 60' Span
Cleveland 65' Span
25-Ton
Whiting 106' Span
Tysaman 60' Span
P&H 70' Span
Morgan 52'3" Span
Cleveland 106' Span
Case 63' Span
Bedford 50' Span
30-Ton
Whiting 80' Span
P&H 80' Span
P&H 60' Span
Morgan 30' Span
Case 41' Span
35-Ton
Bedford 50' Span
Northern 22' Span
50-Ton
Shaw 95' Span
Shaw 69'10" Span
Dominion 80' Span
Cleveland 71'10½" Span
75-Ton
Morgan 59'2½" Span
Alliance 78' Span
Alliance 37' Span
80-Ton American 40'6" Span
125-Ton Morgan 100' Span
150-Ton Whiting 30' Span
175-Ton Morgan 84' Span
200-Ton Alliance 100' Span

Telephone us collect to discuss your requirements.

ECONOMY CO., Inc.
49 Vanderbilt Avenue, New York 17, N. Y.
Telephones: MUrrayhill 4-2294, 4-2893, 4-2295, 4-2844, 4-2296, 4-3292

IMMEDIATELY AVAILABLE

2—500 HP B & W Sterling Boilers, 250# pressure. Class H4-No. 24, each in single setting. 2 steel guyed stacks 5' x 150'—all complete, with or without Dutch Ovens, still setup. Perfect condition. Installed new 1942.

WIRE—WRITE—PHONE
Send for printed Circular

Newberry Manufacturing Co.
P. O. Box 295 Newberry, Michigan
Telephone Newberry 16

200 KW GENERATOR SETS 100 KW

GENERAL MOTORS DIESEL ENGINES
8 Cylinder Model 8-268A
6½" Bore x 7" Stroke
Direct Connected to
200 K.W. WESTINGHOUSE ALTERNATORS
3 Phase, 60 Cycle, 440 Volt. Inc. Switchboards. BUILT 1943
LATEST MODEL

3 Cylinder
GENERAL MOTORS DIESEL ENGINE SETS:
Direct Connected to
100 K.W. CENTURY ALTERNATORS
3 Ph., 60 Cy., 440 Volt. Inc. Switchboards
IMMEDIATE SHIPMENT

ALJON ELECTRIC DIESEL CO.
904 Pacific Street Sterling 3-6515 Brooklyn 16, N. Y.

FOR SALE

TURBINE GENERATOR

Steam Terry, Type C-2, Serial #19031, 500 KW, Steam Pressure 175 lbs. back pressure 18 lbs. 1800 RPM with lubricating oil pump for force lubrication to governor and throttle control.

GLAZER STEEL CORP.
610 Chamberlain St. Knoxville, Tenn.
Phone 3-0738

MOTOR GENERATOR SET

1—200 KW 250 volt Compound Wound 1200 RPM direct connected to 1 - 288 HP 3 phase 60 cycle, 440 volts, 1200 RPM synchronous motor Allis Chalmers .8 P.F. 3 bearing, mounted on a common factory built base complete with AC and DC switchboard with auto transformer for automatic start.

Wire Orders Immediately.

THE MOTOR POWER CO. OF NEW YORK, INC.
859 Madison Avenue, New York 21, N. Y.
RHinelander 4-6478

ADVERTISERS' INDEX

Where an * appears after a name the advertisement does not appear in this issue, but appeared in preceding issues.

Adams Co., R. P. *
Airetool Mfg. Co. *
Air Preheater Corp. 223
Air Transport Ass'n of America for Railway Express Agency 148
Ajax Flexible Coupling Co. 192
Alco Products Div. 48–49
Allen-Sherman-Hoff Co. *
Allis-Chalmers Mfg. Co. 47, 53, 163
Alloy Steel Products Co. *
Allpax Co. 188
American Blower Co. 272
American Brass Co. 131
American Chain & Cable Co. *
American Chimney Corp. *
American Coal Burner Co. 306
American District Steam Co. 186
American Engineering Co. 50–51
American Locomotive Co. 48–49
American Manganese Steel Div. 166
American Metal Hose Branch 175–176
Amer. Radiator & Std. Sanitary Corp. 272
American Pulverizer Co. 233
American Sand-Banum Co., Inc. 196
Ames Iron Works 283
Anaconda Wire & Cable Co. 155
Anchor Packing Co. 181
Anderson Co., V. D. 149
Ansul Chemical Co., Fire Ext. Div. *
Arkansas Fuel Oil Co. *
Armstrong Cork Co. 187
Armstrong Machine Works 102–103
Asbestos, Textile & Packing Div. Raybestos Manhattan, Inc. 286
Atlas Valve Co. *
Automatic Control Co. 216

Babbitt Steam Specialty Co. 204
Babcock & Wilcox Co. 4–5
Babcock & Wilcox Tube Co. *
Bacharach Ind. Instrument Co. 302
Badenhausen, Inc., J. Phillips *
Badger & Sons Co., E. B. 227
Bailey Meter Co. 12–13
Baldwin-Hill Co. 150
Bartlett Hayward Div. (Koppers Co.) 295
Bartlett & Snow Co., C. O. 269
Bates & Co., Walter 312
Beaumont-Birch Co. 182
Belco Ind. Equipment Div. 218
Belmont Packing & Rubber Co. 160
Bernitz Furnace Appliance Co. *
Betz & Co., W. H. & L. D. 56–57
Biddle Co., James G. 261
Bird-Archer Co. *
Black, Sivalls & Bryson, Inc. 231
Blaw-Knox Co. 229
Boiler Tube Co. of America 306
Bonney Forge & Tool Works *
Boston Woven Hose & Rubber Co. 270
Botfield Refractories Co. 218
Bowser, Inc. 202
Brickseal Refractory Co. 182
Bridgeport Brass Co. 268
Brooke Engrg. Co. *
Brownell Co. *
Brown Instrument Co. 207
Brunt Equipment Co. *
Buell Engrg. Co., Inc. 235
Buffalo Forge Co. 205
Buffalo Pumps, Inc. 257
Bull Dog Electric Products Co. 246
Burke Electric Co. *
Burlington Instrument Co. *
Bussmann Mfg. Co. 18–19
Byers Co., A. M. 64
Byron Jackson Co. *

Cabot, Inc., Samuel *
Canton Stoker Corp. 288–289
Carborundum Co. 291
Cardox Corp. *
Cash Co., A. W. 161
Cash Valve Mfg. Corp. A. W. *
Chapman Valve Mfg. Co. 147
Chase Brass & Copper Co. *
Chicago Metal Hose Corp. 172
Chicago Pneumatic Tool Co. *
Cities Service Oil Co. *
Clarage Fan Co. 240
Clark Mfg. Co. *
Cleaver-Brooks Co. 234
Coats Machine Tool Co. *
Cochrane Corp. 198, 237
Coffin, Jr. Co., J. S. 216
Combustion Engrg. Co. 10–11
Cooper-Bessemer Corp. 284
Coppus Engrg. Corp. *
Corning Glass Works *
Crane Co. 133
Cryer Trap & Valve Co. 194
Cuno Engrg. Co. *
Cutler-Hammer, Inc. 121
Cyclotherm Corp. 280

Dampney Co. of America *
Dart Mfg. Co., E. M. 156
Daugherty Co. Inc. *
Davis Engrg. Co. 228
Davis Regulator Co. 154
Dayton Rubber & Mfg. Co. 241
Dearborn Chemical Co. *
De Laval Separator Co. 273
De Laval Steam Turbine Co. 60, 210
Deming Co. *
Detroit Stoker Co. 249
Diamond Power Specialty Corp. 8–9
Dixon Crucible Co., Jos. *
Dodge Mfg. Corp. 225
Dollinger Corp. *
Dominion Chemical Co. *
Dowell, Inc. 183
Drew & Co., E. F. *
Dudgeon, Inc., Richard *

Eagle Mfg. Co. *
Eagle Picher Sales Co. *
Edward Valves, Inc. 127
Electric Fish Screen Co. 210
Electric Machinery Mfg. Co. 301
Electric Storage Battery Co. *
Electro Metallurgical Co. *
Elgin Softener Corp. *
Elliott Co. 6–7, 271
Engineer Co. 304
Everlasting Valve Co. *

Faber Engrg. Co. *
Fairbanks Co. 242
Fairfield Engrg. Co. *
Fairmont Coal Bureau 177
Fischer & Porter Co. *
Flexitallic Gasket Co. 239
Flexo Supply Co. 204
Flexrock Co. 310
Flynn & Emrich Co. 224
Foster Engrg. Co. *
Foster Wheeler Corp. 32–33
Foxboro Co. *
France Packing Co. *
Frick Co. *
Fuller Co. *
Fyr-Feeder Spreader Stoker 306

Gardner-Denver Co. 236
Garlock Packing Co. 258
General American Transportation Corp. 251
General Cable Corp. *
General Coal Co. *
General Electric Co. (Apparatus Dept.) 24–25, 34, 151, 157–158, 221
General Electric Co. (Appliance & Merchandise Dept.) *
Gifford-Wood Co. 287
Globe Steel Tubes Co. 260
Goetze Gasket & Packing Co. *
Golden-Anderson Valve Specialty Co. 307
Goodyear Tire & Rubber Co. *
Goulds Pumps, Inc. 195
Graver Tank & Mfg. Co. 311
Graybar Electric Co. *
Green Fuel Economizer Co. 226
Greene, Tweed & Co. 253
Grinnell Co. 3rd Cover
Griscom-Russell Co. 213
Gulf Oil Corp. 217
Gulf Refining Co. 217

Hagan Corp. 28–29
Haering & Co., Inc. D. W. *
Habn Equipment Co. 310
Hall Laboratories 44–45
Haynes Stellite Co. *
Hays Institute of Combustion 190
Heacon, Inc. 294
Hendrick Mfg. Co. 206
Hendy Iron Works, Joshua 153, 219
Henszey Co. 168
Hercules Float Works 204
Hill Pump Valve Co. 318
Hoffman Combustion Engrg. Co. *
Hoffman Specialty Co. *
Homestead Valve Mfg. Co. 266
Hoppes Mfg. Co. 312

Ideal Industries, Inc. 292
Infilco, Inc. 192B
Ingersoll-Rand Co. 201
Inland Stel Co. 314
International Cementers, Inc. *
International Exposition Co. 264
International Nickel Co. 46, 165
Iron Fireman Mfg. Co. 16–17

Jefferson Union Co. 184
Jeffrey Mfg. Co. 250
Jenkins Bros. 138–139
Johns-Manville, Inc. 143
Johnson Service Co. 248
Jones & Laughlin Steel Corp. 169
Jones Foundry & Machine Co., W. A. 319
Joy Mfg. Co. (La-Del Div.) *
Joy Mfg. Co. (Sullivan Div.) 255

Keasbey & Mattison Co. 232
Kellogg Co., M. W. 281
Kennedy Valve Mfg. Co. 262
Kennedy-Van Saun Mfg. & Engrg. Corp. 14–15
Kewanee Boiler Corp. 188
Kieley & Mueller, Inc. 276
Koppers Co. 295

Ladish Drop Forge Co. 192A
Laminated Shim Co. *
Leeds & Northrup Co. 2nd Cover
Leslie Co. *
Lincoln Electric Co. *
Linde Air Products Co. 265
Link-Belt Co. 3
Liquid Conditioning Corp. 293
Liquidometer Corp. 320
Locke Regulator Co. 310
Lubriplate Div. Fiske Bros. Refining Co. 312
Ludlow Valve Mfg. Co. 178
Lummus Co. *
Lumnite Div., Univ. Atlas Cement Co. *
Lunkenheimer Co. 40–41

MacWhyte Co. 206
Manhattan Rubber Div. Raybestos-Manhattan, Inc. *
Manheim Mfg. & Belting Co. *
Manzel Brothers Co. *
Marion Machine, Foundry & Supply Co. 306
Mark & Co., Clayton 212
Marley Co. *
Marsh Corp., James P. 278
Mason-Neilan Regulator Co. 282
McAlear Mfg. Co. *

McGraw-Hill Book Co. 298, 314
Mercoid Corp. 196
Midwest Piping & Supply Co. 300
Minneapolis-Honeywell Regulator Co. 297
Mitchell Co., W. K. 247
Modine Mfg. Co. 22–23
Murray Iron Works Co. 180

National Airoil Burner Co. 214
National Aluminate Corp. 137
National Tube Co. ..... *
National Valve & Mfg. Co. 274
Niagara Blower Co. 170
Nicholson Co., W. H. 200
Nordberg Mfg. Co. 171
Northern Equipment Co. 141
Norton Co. 317
Nugent & Co., W. W. 302

Oakite Products, Inc. 198
Ohio Injector Co. 259
Orr & Sembower, Inc. ..... *
Otis Elevator Co. 252
Owens-Corning Fiberglas Corp. ..... *

Pacific Pumps, Inc. ..... *
Packless Metal Products Corp. ..... *
Parker Appliance Co. 296
Peabody Engrg. Corp. 290
Peerless Pump Div. 298
Permutit Co. 190, 263
Persson Co., T. G. 178
Philadelphia Gear Works 197
Pipe Fabrication Institute 277
Pittsburgh Piping & Equipment Co. 303
Pilbrico Jointless Firebrick Co. ..... *
Powell Co., Wm. 58–59
Powers Regulator Co. 318
Prat-Daniel Corp. 309
Preferred Utilities Mfg. Corp. 162
Pritchard & Co., J. F. 315
Proportioneers, Inc. ..... *

Q-P Mfg. Co. 218
Quaker Rubber Corp. 320

Raybestos-Manhattan, Inc. 286
Raytheon Mfg. Co. (Industrial Electronics Div.) 38–39
Reading, Pratt & Cady Div. ..... *
Reliance Electric & Engrg. Co. ..... *
Reliance Gauge Column Co. 159
Republic Flow Meters Co. 20–21
Republic Rubber Div. (Lee Tire & Rubber Co.) 254
Republic Steel Corp. 243
Research Corp. ..... *
Resinous Products & Chemical Co. ..... *
Revere Copper & Brass, Inc. 135
Rhoads & Sons Co., J. E. ..... *
Richardson Scale Co. 188
Ric-Wil Co. ..... *
Ridge Tool Co. 267
Riley Stoker Corp. 98–99
Robins Conveyors, Inc. ..... *
Rockbestos Products Co. 305
Roebling's Sons Co., J. A. ..... *
Roper Corp., Geo. D. ..... *
Ross Heater & Mfg. Co. 244
Roto Div. of Elliott Co. ..... *

Sarco Co. 189
Sauerman Bros. Inc. 184
Scherr Co., Geo. 216
Schramm, Inc. 152
Schutte & Koerting Co. ..... *
Scovill Mfg. Co. 203
Shaw Co., B. F. 191
Sier-Bath Gear Co. (Pump Div.) ..... *
Sinclair Refining Co. 193
Sivyer Steel Casting Co. 179
Skinner Engine Co. ..... *
Sloan Valve Co. ..... *
Smith Refractories, Sanford C. 318
Smooth-On Mfg. Co. 308
Socony-Vacuum Oil Co. ..... Back Cover
Springfield Boiler Co. 37
Square D. Co. 185
Squires Co., C. E. 302
Standard Oil Co. of Calif. 285
Standard Oil Co. of Indiana 35–36
Standard Pressed Steel Co. 210
Steel & Tubes Div. 243
Stephens-Adamson Mfg. Co. 52
Sterling Engrg. & Mfg. Corp. 218
Stickle Steam Specialties Co. 164
Stock Engrg. Co. 174
Stomac Engrg. Co. ..... *
Stone & Webster Engrg. Corp. ..... *
Strong Carlisle & Hammond Co. 238
Struthers Wells Corp. 275
Sturtevant Co., B. F. 30–31
Sturtevant Mill Co. ..... *
Sun Oil Co. 125
Swartwout Co. 348
Syntron Co. ..... *

Taylor & Co., W. A. 220
Taylor Forge & Pipe Works 211
Taylor Instrument Co's 54–55
Templeton Mfg. Co. 218
Terry Steam Turbine Co. 173
Texas Co. 26–27
Thermix Engrg. Co. 294, 309
Thermoid Rubber Div. 209
Tidewater Associated Oil Co. 209
Timken Roller Bearing Co. 256
Toledo Pipe Threading Machine Co. 230
Tripp Metallic Packing Co. 318
Troy Engine & Machine Co. 167
Tube Turns, Inc. 145

Union Carbide & Carbon Corp. 265
Union Chain & Mfg. Co. ..... *
Union Iron Works ..... *
U. S. Gauge Div. American Machine & Metals, Inc. 200
U. S. Rubber Co. ..... *
U. S. Steel Corp. ..... *

Viking Pump Co. 318
Vogt Machine Co., Henry 199

Waite Construction Co. ..... *
Wallace & Tiernan Products Inc. ..... *
Walworth Co. 270
Warren Steam Pump Co. 313
Watson-Stillman Co. ..... *
Webster & Co., Warren 129
Western Chemical Co. ..... *
Westinghouse Electric Corp. 62–63
Weston Electrical Instrument Corp. 220
Wheeler Mfg. Co., C. H. 215
Where To Buy 318
Whitlock Mfg. Co. 194
Wickes Boiler Co. ..... *
Wiedeke Co., Gustav 319
Williams Gauge Co. ..... *
Wilson Inc., Thomas C. ..... *
Wing Mfg. Co., L. J. 208
Wrigley Jr. Co., Wm. 308

Xzit Sales Co. ..... *

Yarnall-Waring Co. 42–43, 123
Youngstown Sheet & Tube Co. 222

Zallea Bros. & Johnson 245
Zernickow Co., O. 318

PROFESSIONAL SERVICES 316

SEARCHLIGHT SECTION

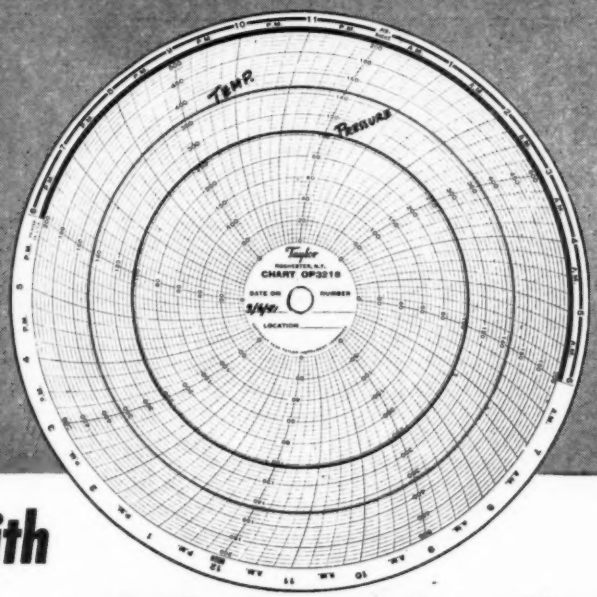
(Classified Advertising)

CLASSIFICATION — PAGE
EMPLOYMENT SERVICE 321
POSITIONS VACANT 321
POSITIONS WANTED 321
SELLING OPPORTUNITIES 321-344
WANTED TO PURCHASE 344
USED EQUIPMENT 322-345

Andren-Myerson Corporation 339
Aljon Elect Co. 341, 345
American Air Compressor Corp. 334
Arnessen Electric Co. 340
Atlantic Transformer Co. 342
Bath Iron Works Corporation 331
Bauer, L. W. 344
Belyea Co., Inc. 325
Benjamin's For Motors 345
Berger Bros. Electric Motors, Inc. 331
Birch Manufacturing Co. 341
Brearley, H. P. 335
Brew, Wolfman & Co., Inc. 332, 342
Buschman Co., Inc., E. W. 340
Carson Machine & Supply Co. 345
Central Pipe & Supply Co. 336
Chicago Electric Co. 337
Cohen Pump & Mchy Co. 339, 342
Commercial Eq. Co. 335
Crystal Ice Works, Inc. 344
Davis Co., J. F. 332
Denny & Clark 343
Duquesne Electric & Mfg. Co. 338
Ebasco Services, Inc. 331
Economy Co., Inc. 345
Electric Apparatus Repair Co. 336
Electric Equipment Co. 334
Electric Generator & Motor Co. 332
Electric Motor & Repair Co. 342
Electric Service Co., Inc. 335
Ellis Co., A. Lee 333
Erie Electric Co., Inc. 337
Fletcher Sales Co. 341
Flushing Electric Corp. 343
Frank Tea & Spice Co. 342
Glazer Steel Corp. 331, 345
Glow-Electric Co. 343
Greenspon's Son Pipe Corp., Jos. 341
H. & P. Machinery Co. 341
Hall & Co., Stephen 340
Harris & Co., Harry 331
Hay & Co., F. W. 341
Heat & Power Co. 330
Hemphill & Co. Inc., J. L. 323
Hooper, Jos. K. 341
Hope Water & Light Plant 344
Howe Brothers 336
Hudson Iron & Steel Co. 324
International Power Machy. Co. 335
Iron-Steel Products Inc. 334
Johnson & Asso., Howard Blaine 334
Keystone Power Plant Eq. Co. 334
Kent Engineering Co. 344
Kemie Co., Fred W. 339
Kirk Co., Wallace E. 333
Land & Co., L. J. 322
Liberty Industrial Salvage Co. 342
Locke, Co., C. B. 334
Lowenstein Bros., Inc. 342
Metropolitan Plumbing Supply Co., Inc. 336, 343
Mac Cabe Co. T. B. 338
Midwest Mfg. Co. 344
Mississippi Valley Equipment Co. 339
Motor Power Co., of N. Y. Inc. 345
Newberry Mfg. Co. 345
Penn Machinery Co. 335, 344
Perfection Gear Co. 334
Philadelphia Transformer Co. 342
Pittsburgh Plate Glass Co. 344
Porter Electric Co., Inc. 341
Power Equipment Co. 343, 344
Power Plant Equipment Co., Inc. 340
Rearick, Charles B. 343
Republic Textile Equipment Co. 332
Ross Power Eq. Co. 342
Schoonmaker, A. G. 326, 327, 333
Schoonmaker, Robert 339
Security Mills, Inc. 334, 344
Shopping News 343
Stanhope, Inch., R. C. 334
Stewart & Co., Inc., Paul 335
Sundfelt Equipment Co. 343
Superior Equipment Co. 341
Utilities Electric Machinery Co. 329
Wagner Co., Arthur 333
Wante Electric Co. 328
Weaver & Co., Charles 336
Wrenn Paper Co., The 342
Wurth Electric Motor Co. 331

UNIFORM RESULTS

that mean economy and safety...



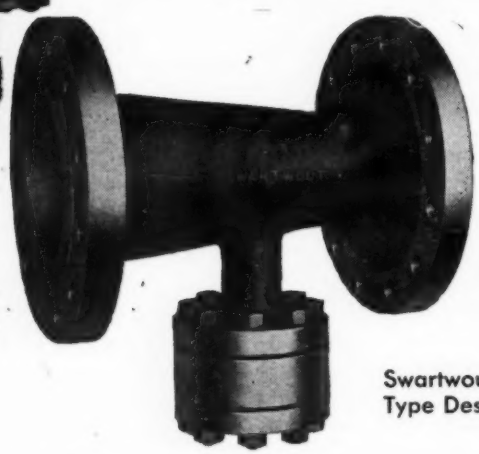
achieved day after day with

Swartwout Reducing and Desuperheating

Swartwout Controls bring you low-cost dependable reducing and desuperheating. Sensitive quick-acting controls assure safe regulation to supply properly converted steam for low-pressure turbines, process requirements, etc.—with negligible maintenance.

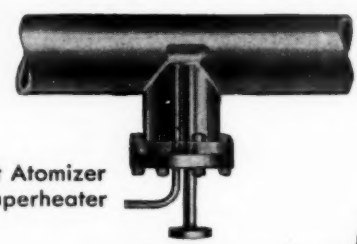
Swartwout Desuperheaters—carburetor, venturi or atomizer types—cool steam with positive uniform results. Swartwout's sensitive diaphragm type Reducing Valves faithfully regulate pressures to within one per cent either way of your demand. Complete station, with special safety features if required, is engineered to suit your requirements, guided by Swartwout's wide experience in this field. Send us details of your reducing and desuperheating problems—for recommendations.

above:
Swartwout Carburetor Type Desuperheater

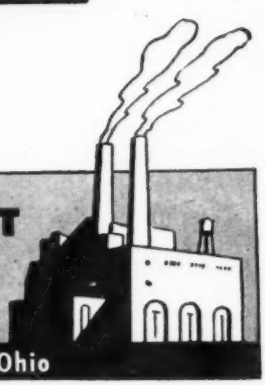


right:
Swartwout Venturi Type Desuperheater

right:
Swartwout Pressure Reducing Valve

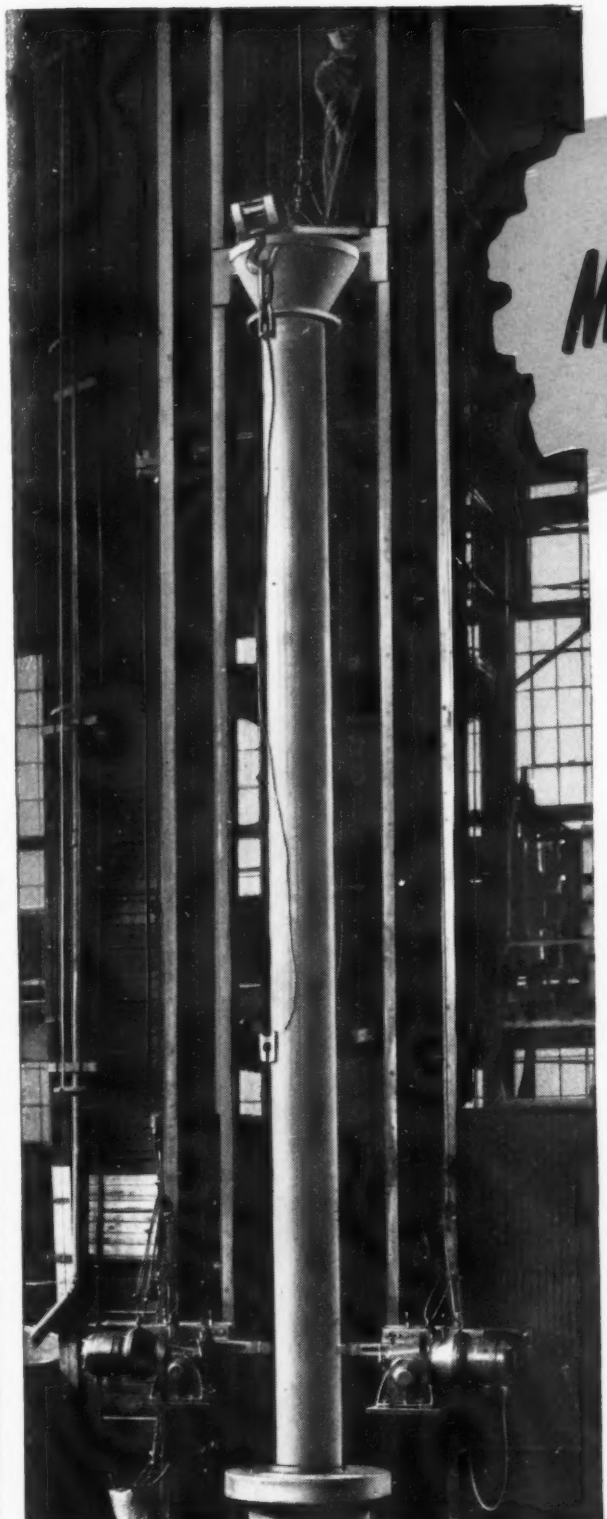


Swartwout Atomizer Type Desuperheater



Swartwout POWER PLANT EQUIPMENT

THE SWARTWOUT COMPANY • 18511 Euclid Ave., Cleveland 12, Ohio



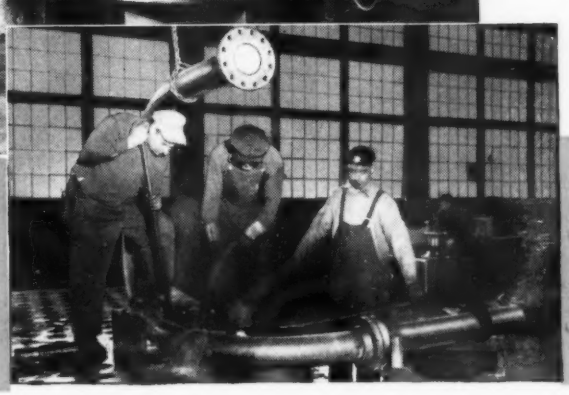
MAINTAINING $\frac{\pi d^2}{4}$ during PIPE BENDING

Typical of the specialized equipment developed by Grinnell for prefabricating piping is this sand filling and packing machine. By solidly packing the pipe with special sand before heating and bending, the possibility of flattening or buckling and consequent constriction of full flow is eliminated. Pipe can be bent accurately to detailed drawing.

By employing these specialized machines and highly skilled techniques, Grinnell assures the exact control of measurements and quality so important to correct alignment and dependable performance of prefabricated piping assemblies.

Complete prefabrication facilities backed by metallurgical research, engineering knowledge and long experience are responsible for the type of work that has established Grinnell as the leading source "whenever piping is involved".

Vibrators packing sand in pipe.



Bending pipe to detailed drawing.

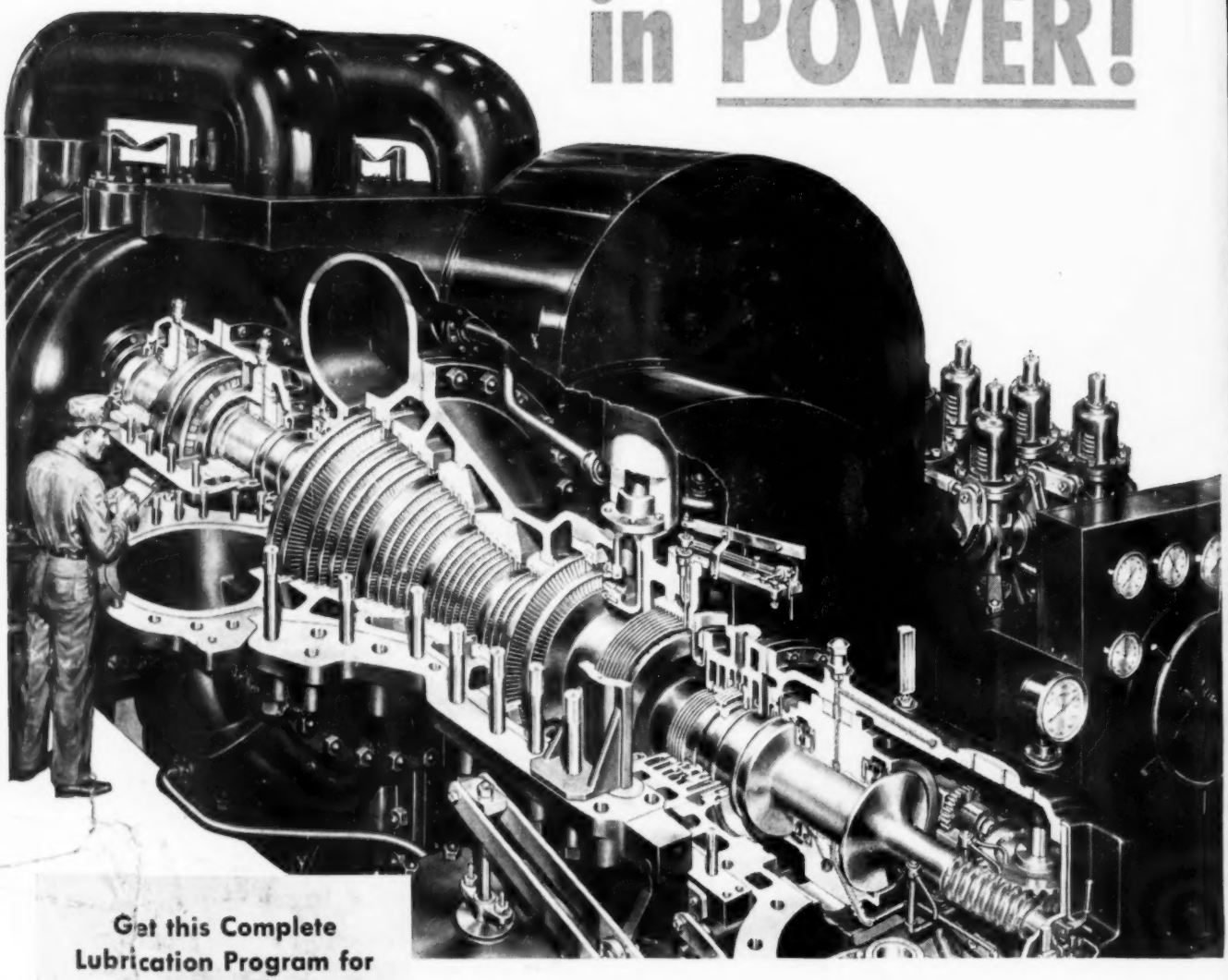
GRINNELL COMPANY, INC.
Executive Offices, Providence 1, R. I.

Pipe Fabrication Plants:
Providence, R. I. Atlanta, Ga. Warren, Ohio

GRINNELL

WHENEVER **PIPING** IS INVOLVED

Proof of a Payoff in POWER!



Get this Complete Lubrication Program for all your machines

- Lubrication Study of Your Entire Plant
- Recommendations to Improve Lubrication
- Lubrication Schedules and Controls
- Skilled Engineering Counsel
- Progress Reports of Benefits Obtained

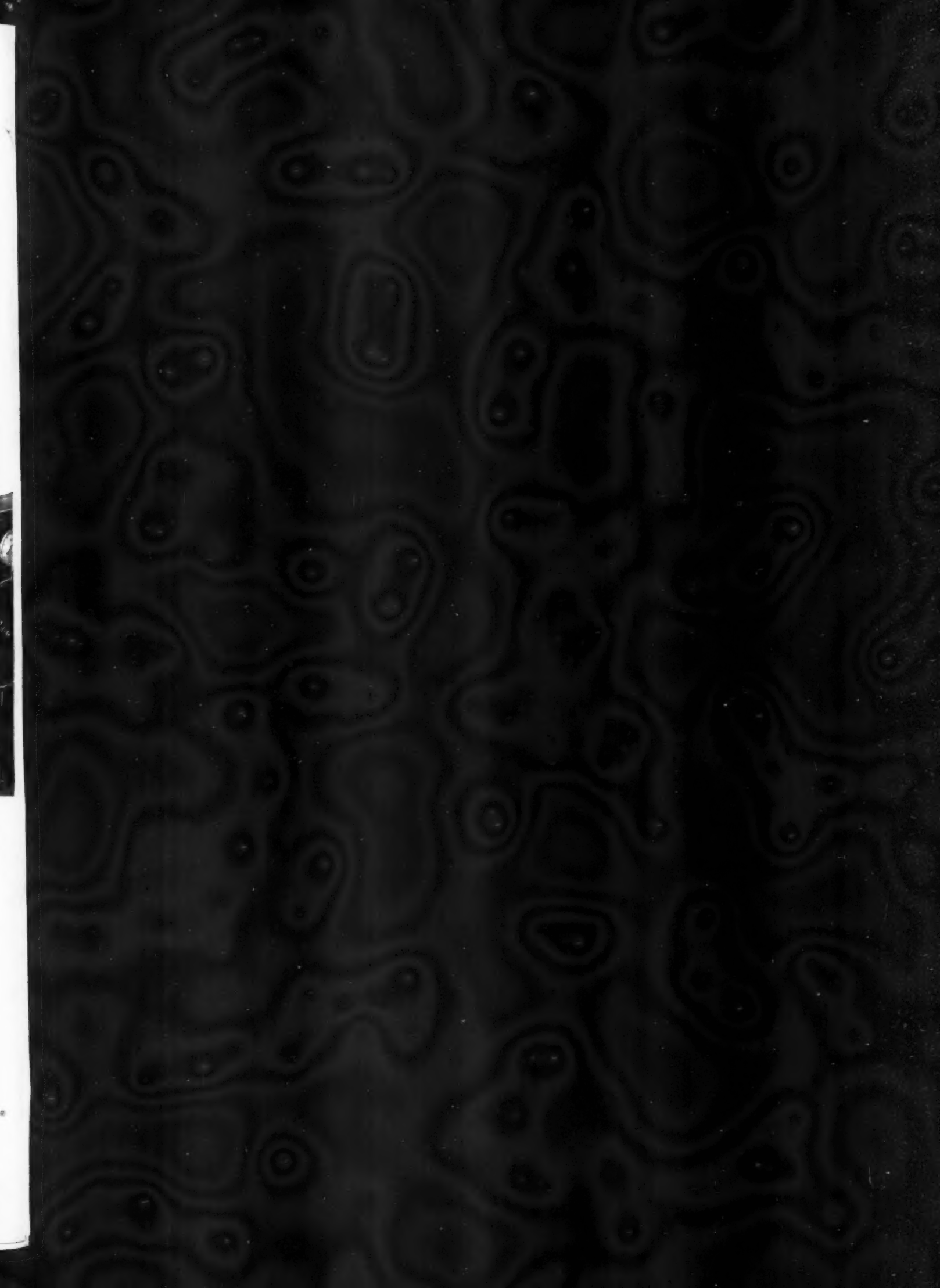
GARGOYLE Lubricants

To get more power out of every ton of coal, turbine manufacturers have boosted the speeds, pressures and temperatures inside modern machines like this. Today, steam pressures have reached beyond 2,000 pounds per square inch. Temperatures have soared as high as 940° F.

This stepped-up temperature has posed a difficult problem for lubricating oil. To meet it, four years ago Socony-Vacuum developed a great new turbine oil and placed it in turbines where other oils had been deteriorating to the point of failure in short periods of time.

The new oil is now giving record-breaking performance in all of these turbines. Analyses show negligible change . . . or no change at all . . . after months and even years in this severe service.

This means more constant, dependable power output and lower ultimate lubrication costs . . . important factors not only for turbines, but also for every other machine. Socony-Vacuum's complete lubrication program assures these benefits for your entire plant. Get this program now for a payoff in production and profits.

Socony-Vacuum Oil Co., Inc.

and Affiliates: Magnolia Petroleum Co., General Petroleum Corporation